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Issue 4 £3.95
UK EDITION
ISSN 2009-597X

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editor's letter

The self-deprecatingly titled sustainability website Treehugger.com is one of the green giants of the internet. Previously rated the top sustainability blog by Neilsen Netratings and included in Time Magazine's top twenty-five blogs, Treehugger attracts masses of readers interested in green living – and green design in particular – from around the world. So it was a great day in the Passive House Plus offices when Treehugger's managing editor Lloyd Alter chanced upon our magazine, and felt sufficiently enthused to write about us.

"What a joy it was […] to discover a new magazine from Ireland, with a UK edition, that is just full of more great green designs of passive houses, multifamily projects, schools office buildings and even boathouses than you could imagine actually existed," wrote Alter, in a blog post about Passive House Plus that made us blush. "I will be dining on this in the pages of TreeHugger for weeks to come."

If that didn't make us happy enough, the fact that we're starting to see a genuine upturn in the number of innovative Irish sustainable building projects our readers are planning gives us real cause for celebration. As you may know, we've been running an enquiry system since long before Construct Ireland evolved into Passive House Plus. Although the primary function of this system is to connect readers planning sustainable build and upgrade projects with the advertisers who meet their needs, it also provides telling glimpses of market sentiment. For instance, just over a fifth of the nearly 300 enquiry forms we've received to date relating to the last UK edition of Passive House Plus included estimated project budgets. Their combined total was nothing short of astonishing: £320m, including £38m worth of projects aiming for certified passive house. Interestingly, 37 of the enquiries were relating to multi unit housing schemes, including six projects aiming for certified passive levels, and a further seven aiming to go "near passive".

It's tremendously heartening that projects of this nature are beginning to happen – and that architects, contractors and clients are looking for help from a magazine about ultra low energy building. They may also find inspiration in the broad range of exemplary projects in this issue, including technical case studies on the three award-winning projects at the recent UK Passivhaus Awards and on three of the best recent Irish passive and near passive projects, as well as the architecturally stunning certified passive homes, museum and skyscraper in our international buildings feature.

We launched Passive House Plus into the UK because of a large and growing demand from British designers, contractors and clients for robust, independent information on building approaches that achieve genuinely low energy results. While it's clear that this demand is growing in spite of underwhelmingly lax energy efficiency standards under building regulations, and while this magazine and the industry forming around passive house can undoubtedly survive and even thrive as a growing niche, our ambitions must be greater. Quite simply, the current minimum standards – and the proposed changes as the UK crawls towards a spurious zero carbon target – are not fit for purpose.

Regards,
the editor

2012 Business magazine of the year - Irish Magazine Awards

Jeff Colley:
winner - green leader award - Green Awards 2010

Construct Ireland:
winner - green communications award - Green Awards 2010

Magazines Ireland

Éasca

Passive House Plus (Irish edition) is the official magazine of Éasca and the Passive House Association of Ireland

Issue 4

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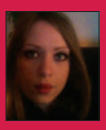

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PRINTING: GPS Colour Graphics,
T: 028 9070 2020
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Publisher's circulation statement: Passive House Plus (UK edition) has a print run of 11,000 copies. 10,000 copies are posted to architects, clients, contractors & engineers. This includes the members of the Passivhaus Trust, the AECB & the Green Register of Construction Professionals, as well as thousands of key specifiers involved in current & forthcoming sustainable building projects

Photograph: Uncertified Enerphit house Co Cork

ABC

ABC certificate pending

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contents

News

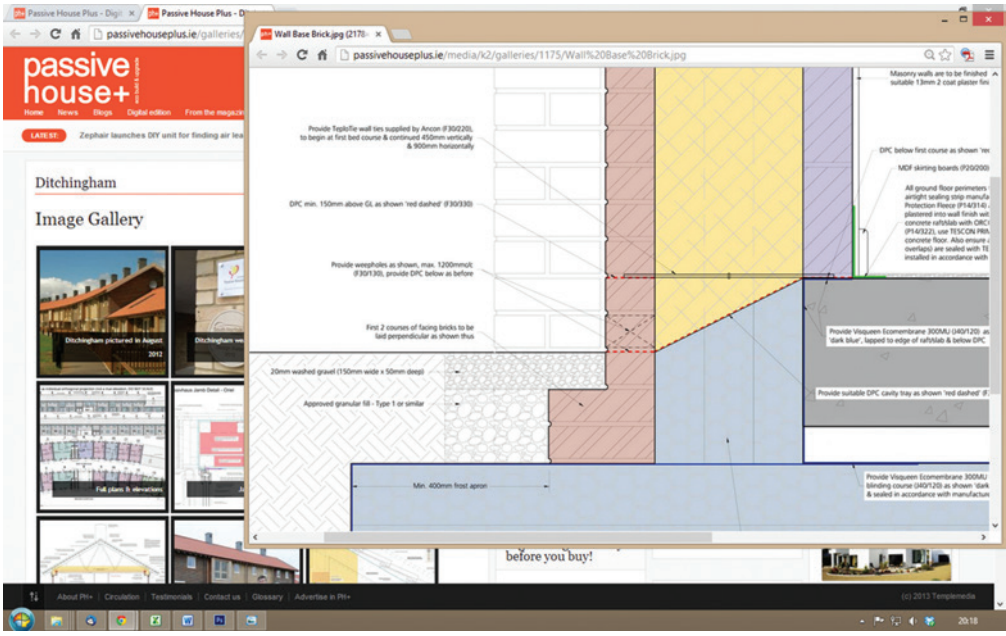
Passive House Plus adds new online image galleries

We're delighted to announce the launch of an exciting new feature for subscribers to the magazine: online image galleries, including detailed architectural drawings of buildings featured in the magazine.

From now on, most case study articles in the digital edition of the magazine will include a link to an online gallery featuring additional images and architectural drawings of the project. These will include detailed diagrams showing insulation, airtightness and thermal bridging details. A beta version of the gallery feature was introduced in the digital versions of our previous issue, including both UK and Irish editions.

Leading low energy architect Joseph Little said: "The new online gallery feature adds a whole new functionality to Passive House Plus. I love the look of it and will enjoy using it."

This feature is only available for subscribers, including both our standard (print magazine and digital access) and digital only options. Subscribers to the print edition also receive a free subscription to the digital edition giving them access to the feature. Subscription rates range from €45 for overseas subscriptions, to £20/€25 for UK subscriptions, to €10 for digital only subscriptions.



An architectural drawing on our new image gallery feature of a thermal bridge free wall base detail at the Parsons & Whittley-designed Ditchingham passive house scheme, which was profiled in the previous issue of Passive House Plus

Government scales back Part L ambitions with 6% carbon reduction

The Department for Communities and Local Government is set to introduce less ambitious carbon reductions for new buildings than it had previously indicated, under planned changes to Part L of the building regulations for England and Wales set to be introduced next year. The department has also launched a public consultation – titled Next steps to zero carbon homes: Allowable Solutions – which proposes carbon offsetting as a means to help achieve a notionally zero carbon rating.

In a written statement to parliament on 30 July, communities minister Baroness Hanham announced plans to introduce carbon reductions of 6% for new homes and 9% for new non domestic buildings.

"These Part L changes take an important and technically meaningful step towards zero carbon homes," said Hanham, "but one that also allows government to meet its commitments to reduce the overall regulatory burden upon home builders."

RIBA's head of external affairs Anna Scott-Marshall expressed the institute's disappointment at the proposed changes. "The government's response will provide much needed clarity to the UK construction industry which we welcome," she said. "These new measures however, are far less ambitious than previously proposed. We will only be a third of the way along the improvement needed for zero carbon homes by 2016. Our collective attempts to achieve affordable zero carbon homes with low energy costs for consumers will suffer greatly because house builders haven't been encouraged enough by government."

The current version of Part L came into force in 2010, and set 25% carbon reductions for new homes compared to 2006 standards as determined using the Standard Assessment Procedure (Sap) software. In addition to the stated carbon target for the building, Part L sets minimum compliance backstops – targets which the building must achieve or exceed – for several aspects of the building.

Although backstop U-values improved in 2010 – walls, roofs, floors and windows respectively improved from 0.35, 0.25, 0.25 and 2.2 in 2006 to 0.30, 0.20, 0.25 and 2.0 in 2010, the backstop for airtightness remained unchanged at 10 $m^3/hr/m^2$ at 50 Pa. This compares unfavourably to the backstops in the Irish version of Part L, which includes 60% energy and carbon reductions and mandatory use of renewable energy systems, as well as backstops of 0.21 for walls, 0.16 for roofs, 0.21 for floors – rising to 0.15 where underfloor heating is installed – and 1.6 for windows, doors and roof lights with an airtightness requirement of 7 $m^3/hr/m^2$ at 50 Pa. But Ireland's backstop U-value for windows, doors and rooflights assumes their combined area represents no more than 25% of floor area, and sets more onerous targets for more extensively glazed buildings – such as a U-value of 0.8 where their combined area is 58.9% of floor area.

Although Baroness Hanham's statement didn't discuss U-values or other envelope backstops, it indicated that fabric requirements will be tightened. "The emphasis of these changes is on getting the building fabric right and this is reinforced through the introduction of a new target for fabric energy efficiency," she said.

The consultation on Next steps to zero carbon homes: Allowable Solutions ends on 15 October. To read the government's proposal and make a submission visit http://bit.ly/16wvQI6

News

Passive House Award open for entry

Photo: Christine Blaser

The 2014 Passive House Award is open for entry. The award, run by the Passive House Institute, aims to illustrate "just how beautifully designed extremely energy efficient buildings can be."

Urban planning projects are eligible for entry this year alongside individual buildings. Passive house or Enerphit certification is required for entry, and projects must also be listed on the International Passive House Association's database at www.passivehouse-database.org

These criteria apply for at least one representative building in the case of urban planning projects, which are still eligible for entry even if they are in the early stages of development.

Judging of the principal award is based solely on architectural design. The prize will be judged by an independent jury, who alongside the main award may decide to specially recognise projects for their unique attributes, such as innovative design, climatic challenges, or unique energy concepts.

Winners will honoured be at the 2014 International Passive House Conference in Aachen, and in a travelling poster exhibition that will tour worldwide.

The 2014 Passive House Award has been organised by the Passive House Institute within the framework of the EU project, PassREg - Passive House Regions with Renewable Energies (www.passreg.eu), under the patronage of the German Federal Ministry of Transport, Building and Urban Development. Prize money will be determined by the jury based on the entries received as well as on the special recognitions awarded and total funding available from sponsors.

The awards were previously held in 2010, as the Passive House Architectural Awards.

Further information and the online submission form can be found at www.passivehouse-award.org

The deadline for applications is 30 September.

(above) The winner of the 2010 Passive House Award, a multi-family building in Liebefeld, Switzerland by Halle 58 Architects

Packed schedule for October's one day Passivhaus Conference

Photo: Passivhaus Trust

This year's UK Passivhaus Conference takes place on Tuesday, 15 October at Jury's Inn, Milton Keynes. This year's conference will run over just one day to reduce costs for those attending and reduce time away from the office. For the first time, Passive House Plus will be the conference's media partner.

The conference will see "all the features from last year and more crammed into just one day", including hands-on training sessions, a full scale exhibition, speed networking sessions and site visits.

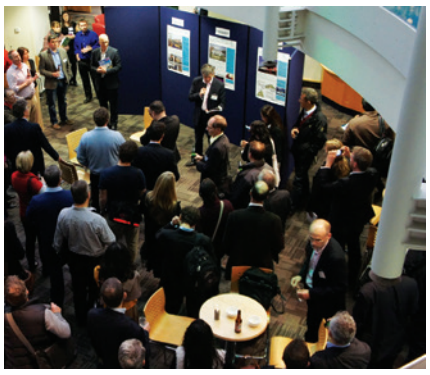
"The focus this year will be to examine what is needed in order to scale up the delivery of passive house in the UK whilst at the same time maintaining high quality standards, including details of the first schemes with over 100 homes, and leading-edge passive house retrofit projects," said Jon Bootland, chief executive of the Passivhaus Trust.

The conference will include sessions on delivering passive house at scale, new project case studies for 2013, and the successful delivery of passive house projects.

Speakers will include architect Marion Baeli of Paul Davis & Partners, Jane Barnes of construction consultants Davis Langdon, Justin Bere of Bere Architects, the Green Building Store's Bill Butcher, Ian Byrne of the National Energy Foundation, passive house consultant Nick Grant, architect Jonathan Hines of Archihaus, and Tomás O'Leary of the Passive House Academy.

The day will include site visits to the Howe Park passive house and to Energy World, a pioneering development of low energy homes and offices that dates from the 1980s.

The conference is run by the Passivhaus Trust and the BRE. Munster Joinery are the lead sponsors, while other sponsors include Accredited Passivhaus Design, Beattie Passive Norse and Internorm UK. The event is also supported by the AECB, the Good Homes Alliance and the University of Nottingham.



Opportunities for sponsorship and exhibiting are now sold out. The confirmed exhibitors are Airflow Developments, Ambiwood, Daylight & Ventilation Solutions, Ecohaus Internorm, Ecological Building Systems, Ecology Building Society, Green Building Store, Isoquick, Magmatech, Passivhaus Homes Ltd. & Saint-Gobain.

(above) Delegates relaxing after a busy day of learning at the 2012 UK Passivhaus Conference

News

Changes needed to kick-start Green Deal, lender warns

The UK government must make urgent changes to the Green Deal to increase public demand, a leading green lender has warned.

Figures released by the Department of Energy and Climate Change in July showed that only 36 of the 45,000 households assessed so far under the Green Deal have signed up for energy upgrade work. Energy minister Greg Barker had previously predicted that the initiative would stimulate up to 10,000 upgrades per year.

According to Ecology Building Society CEO Paul Ellis, the scheme must be improved to drum up interest. “We’re disappointed but not surprised by these results,” he said. “The urgent economic and environmental need to make our homes more efficient isn’t matched by demand from homeowners, and the incentives provided by the Green Deal just aren’t enough to create this market. We need to see a more competitive interest rate, a simpler process and wider policy initiatives to drive take-up, such as an energy efficiency feed-in tariff, council tax or stamp duty discounts.

Ellis said that the banking sector also had a key role to play in stimulate demand. “Banks and building societies have their role to play, too,” he said. “Our C-Change retrofit discounts have led the way in showing that mortgage lending can support people to reduce their home’s carbon emissions. Now we need others to follow suit.” Ecology’s C-Change mortgages offer 1% interest rate reductions for homes

Photo: Christopher Kenworthy

that meet standards such as passive house and Enerphit.

“This isn’t just about being green – in an era of rising fuel costs, it’s about a sensible long term approach to finance,” he said. “We now know that a higher EPC rating can have a real impact on a home’s selling price, and evidence from the US suggests that mortgages on energy efficient homes are less likely to default.”

According to Russell Smith, managing director at energy upgrade specialists Parity Projects, the Green Deal has a role to play, but is only ever likely to be one of many finance solutions for retrofit. “Historically much of our work as an independent and impartial adviser has come from households who see energy efficient retrofit as simply one part of a wider property renovation project,” he said. “For those people, the Green Deal simply doesn’t represent good value, nor is it well suited to more complex projects.

“If we are to achieve the scale of retrofit required to meet the UK’s climate and energy objectives it is imperative that there are alternatives that cater for all-comers, and as the Green Deal starts to find its feet we are seeing these emerge. We like to think that our work with Ecology blazed a trail in that respect, with our Home Energy Masterplan service offering a high-quality alternative to Green Deal assessments and their C-Change discounts representing a viable alternative to Green Deal finance.

Of course having a range of retrofit “routes” out there is not only good for households – giving them greater choice – but is also great for businesses who can’t afford to wait for the Green Deal to create a market for their services,” Smith said.

Ecology CEO Paul Ellis (above centre) has called for changes to the Green Deal to stimulate demand

Homes at London mixed-use passive scheme selling well

Designed by Cartwright Pickard Architects, Octavia's Sulgrave Gardens is London’s largest mixed-use passive house scheme to date, costing £1,821 per sq m to build. The 2,855 square metre development, now being marketed as 'The Greenhauses', comprises 30 mixed tenure apartments and houses, including thirteen shared ownership, nine affordable rent and eight 2/3 bed private townhouses priced from £750,000 up – seven of which have already been sold.

Established by Octavia Hill, the Victorian social reformer and founder of the National Trust, Octavia has become a prominent housing development organisation managing a portfolio of high quality and sustainable homes in Central London. Octavia have a strong track record for building award winning schemes with a focus on social and environmental sustainability. Their upgrade to 100 Princedale Road – a mid terrace listed Victorian building in a conservation area which became the UK’s first upgrade project to achieve full passive house certification – featured in issue three of Passive House Plus.

(right) Sulgrave Gardens is London’s largest mixed use passive house development yet built

News

Princedale launches cladding system for multi-storey passive house

Passive house specialists Princedale Homes have announced the launch of a composite cladding system for multi-storey passive house construction onto the UK market. According to Princedale director Bram De Bruycker – a pioneer of the Belgian passive house movement – the system delivers a fully clad, air-tight, insulated, breathable building envelope to passive house standard for concrete and steel framed buildings – with windows and building services pre-installed.

Developed over seven years, the system was designed specifically for multi-storey passive house construction in Belgium and has been used for offices, schools, high-rise accommodation (in particular social housing) and public buildings. The company said that it is also flexible enough to reflect a wide variety of architectural styles, preserving the architect's original vision.

According to De Bruycker, Princedale designs and manufacturers each system to the architect's requirements, and takes responsibility for the installation and delivery of the airtight building envelope. "The system will continually evolve and improve with each iteration, ensuring each project is constructed with the most up to date solutions possible," he said.

De Bruycker said the company starts with detailed technical design and planning to ensure that any issues with airtightness, thermal bridging, condensation and insulation are pre-empted and designed out before work on site begins. "The panels are then millimetre-precision prefabricated," he said, "including pre-installation of windows and the application of external cladding such as render, timber, metallics or brick slips, ready for delivery to site." Installation is designed to be fast and efficient utilising a small team, even on large buildings, and no scaffolding is required.

The system is capable of delivering a U-value of 0.1 to a large building, delivers a fully airtight building envelope, and is designed to eliminate build-up of interstitial condensation. It is factory manufactured and can accommodate a range of insulation thicknesses.

Princedale's composite cladding system has previously been used on several certified passive house projects in Belgium including the five-storey Molenbeek social housing project (above) and nine storey offices for Belgian electricity utility Elia (left)

Target Zero to host passive house trades course in November

Passive house training provider Target Zero is planning a tradesperson course to run in England in November. The one week course – which covers building envelope and services – has been prepared in advance of the certified passive house tradesperson exams on 29 November. Discounts are available where companies send multiple attendees.

Target Zero provides Passive House Institute accredited training, including certified passive house designer courses in addition to the tradesperson courses.

The company runs the passive house designer course over ten days, while the tradesperson course includes both the building envelope and building services modules and is held over five days.

"As of this year we haven't had any failures on any of the courses," said Target Zero's Darren O'Gorman. He told Passive House Plus that a lot of the training he provides is in-house to companies or institutions. Target Zero also provides training in thermal bridge analysis.

O'Gorman recently delivered the passive house tradesperson course to faculty staff at South West College, Omagh. The college offers courses in sustainable construction, building services and architectural technology.

O'Gorman is now returning to the college to deliver the passive house designer course. He will also be delivering the tradesperson course to a window company in Scotland later this year.

He also told Passive House Plus that the first two certified passive house tradesmen in the UK were in fact trained in Ireland by Target Zero.

O'Gorman became interested in passive house design in 2005 when he bought a cottage himself and renovated it to a low energy standard.

The company recently opened a new Irish training centre at the Campus Innovation Centre, IT Carlow.

News

Heliotherm releases Android app for remote heat pump control

Heliotherm has launched HelioDroid, an Android app that enables users to control their Heliotherm heat pump remotely wherever a web connection is available.

The app allows users to view heat pump performance data, and to adjust operating modes and room temperatures. Any errors are immediately and automatically reported by a signal to the mobile phone user, without having to open the application.

HelioDroid was developed by Heliotherm's own research and development headquarters. The company's CEO Andreas Bangheri has also confirmed that an iPhone version of the app is currently in development.

Heliotherm was founded in 1987 by Bangheri and has been based in Langkampfen, Tyrol, Austria since 2007. With a workforce currently consisting of 65 employees, the company "focuses exclusively on the development and production of high efficiency heat pumps".

To date more than 25,000 of its heat pumps have been installed, and about 75% of the heat pumps it manufactures are exported.

(above) Austrian heat pump manufacturer Heliotherm's base in Langkampfen, Tyrol

Passive houses to open doors from 8-10 November

A house or office designed to be so energy efficient that it doesn't need a conventional heating system sounds great in theory – but what's it like to be in such a place?

From 8 – 10 November 2013, owners and residents of passive buildings are being urged to help the public answer that question by opening their doors for the 10th annual International Passive House Days.

At the UK Passivhaus Open Days, visitors will have the opportunity to experience the comforts of the passive house standard first hand. A range of projects designed by different architects and built using various construction methods will be open to the public including private houses, social housing, community buildings, office buildings and refurbished properties.

The event is organised by the Passivhaus Trust in conjunction with The International Passive House Days set up by the International Passive House Association (iPHA). The iPHA event is currently in its 10th year and will have projects from all over the world open to the public.

To participate in the International Passive House Days, register your project with the International Passive House Database at www.passivehouse-database.org

Registration is free of charge. Detailed registration instructions can be found on the iPHA website.

If you have a passive house – either under construction or complete – that you'd like to open up to visitors during 8-10 November visit bit.ly/1czilt9 for details on how to register your project.

As the event draws close, participating projects in the UK and internationally will be listed on www.passivhausprojekte.de/projekte.php

Hadlow Rural Regeneration Centre, Tonbridge (left) and the Denby Dale Passivhaus (right) were two of twelve UK passive house projects to open their doors for the 2012 International Passive House Days

News

Devon, Lancashire and Wales win at UK Passivhaus Awards

Photo: Passivhaus Trust

The winners of the 2013 UK Passivhaus Awards were announced at a ceremony at the residence of the Austrian Ambassador in London on 4 July.

The Totnes passive house B&B emerged as the winner in the private housing category. This deep retrofit and extension to a modernist cavity wall house in Devon achieved the seemingly impossible: full passive house certification for an upgraded building. The project predated the creation of the Passive House Institute's standard for upgrade projects, Enerphit.

The Lancaster Cohousing project in Lancashire won in the social/group housing category. This development features 41 certified passive dwellings, 35 of which are part of a cohousing community that shares facilities including communal kitchen, dining area, and outdoor spaces.

In the non-domestic category, the Canolfan Hyddgen local authority office building and IT training facility in Machynlleth, Wales, was victorious.

All three projects are the subject of detailed case study articles in this issue of Passive House Plus. Other shortlisted projects such as Plummerswood, Ditchingham and Green Base have featured in previous issues.

The full list of shortlisted projects for this year's awards were:
Private Housing (sponsored by Ecology Building Society): Crossway, Hawkes Architecture Ltd; Plummerswood, Gaia Research; Totnes Passivhaus, Passivhaus Homes Ltd.

Social Housing (sponsored by Kingspan Insulation Ltd): Ditchingham Passivhaus, Parsons & Whittley; Lancaster Cohousing Project, Eco Arc Architects; Racecourse Passivhaus Bungalows, by Gentoo.

Non-domestic (sponsored by Munster Joinery): Canolfan Hyddgen, JPW Construction; Green Base, Simmonds Mills Architects; Interserve Office, Interserve.

Pictured (l-r) are private housing finalists Prof Sandy Halliday, Gaia Architects; Richard Hawkes, Hawkes Architecture; Jon Lee, Ecology Building Society; award winners Adam Dadeby & Janet Cotterell, Passivhaus Homes Ltd along with Bouke Martinot of the Totnes passive house build team; and Jon Bootland, Passivhaus Trust

ProAir gets high marks on Sap Appendix Q

Irish manufacturer ProAir has just had its PA600 LI heat recovery ventilation unit listed on the Sap Appendix Q database with some of the best results on the market.

In independent tests carried out by BRE, the unit achieved a specific fan power of 0.57, and heat recovery efficiency of 94%.

"We're up there with the best," said ProAir's David McHugh. "Only one other unit on the list is above this at 95% and that is a Paul unit, but this same unit has a lower SFP rating, so if one takes the combined high thermal and electrical efficiency in combination the PA600 LI could be described as the most efficient on the market."

McHugh explained that the PA600 LI is made from high density polyethylene foam. "The advantage of that is that it makes for a very well-sealed unit and this contributes to its high efficiency. In addition, this is also one of the quietest on the market as all the components are suspended within the foam," he said.

McHugh said that the high insulation value of the foam means that it's ideal for use within the thermal envelope, but can also tolerate being in a cold attic space if necessary. At a weight of only 27kg it can be installed by just one person, he said.

(right) ProAir's PA600 LI MVHR system has achieved a Sap Appendix Q rated heat recovery efficiency rate of 94%

News

Zephair launches DIY unit for finding air leaks

Renowned Irish airtightness consultant Mark Shirley has announced the launch of the Zephair Pre Pro, an "easy to use and reliable way to perform quality control of your airtight layer by under pressurising a building".

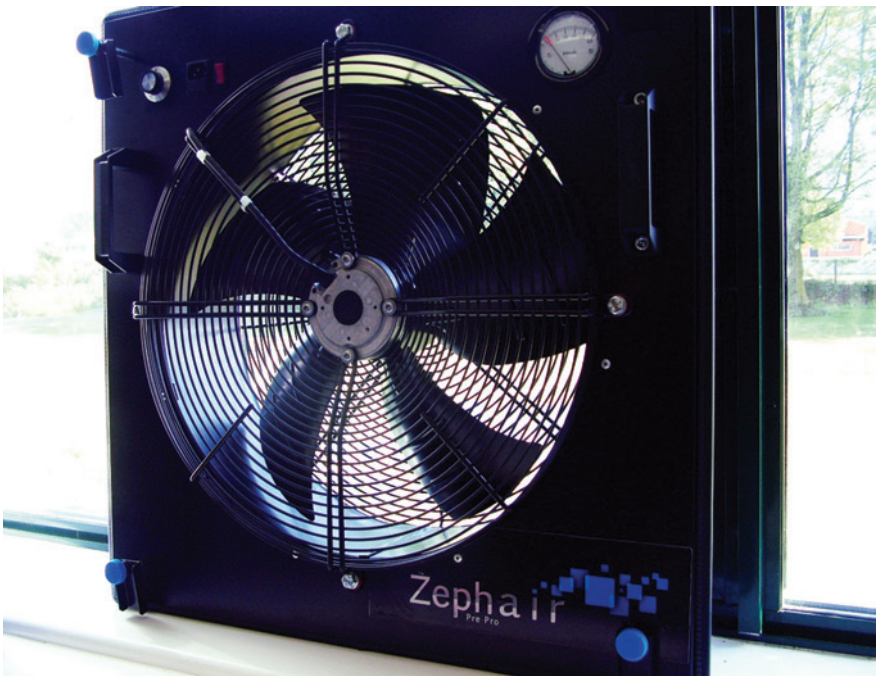
This DIY system is designed to allow users to find air leaks in the building envelope before an airtightness tester comes on site.

“Air is free. Uncontrolled air is expensive,” said Zephair's Mark Shirley. "As the building is being under pressurised you can walk the building and find the cracks & gaps in the continuous airtight layer. Once you have achieved 50 Pa pressure and you can no longer find any leaks in the envelope then your building, or part of the building, is ready for testing."

The Pre Pro is designed to fit into either an inward or opening window or door.

"The Pre Pro is easy to set up and operate and you can start looking for leaks within 10 minutes of starting to build the device into a window or door," Shirley said.

The Pre Pro has a dial that shows the pressure difference between the outside and inside of the building. "If you can achieve a 50 Pa pressure difference with the Pre Pro, you can be confident that when the professional tester turns up they too will be able to achieve the pressure threshold required to test to the relevant standards," he added.



The Zephair Pre Pro is designed and manufactured in Ireland.

X Floc hosts first ever blown insulation symposium

On 7 and 8 June the first ever Insulation Blowing Symposium took place at the factory of X-Floc, the German manufacturer of insulation blowing machines, in Renningen, Germany. Among the guests were installers, manufacturers of blown insulation machines, insulation material manufacturers, retailers, and representatives of research and education.

Axel Greiner, CEO of X-Floc said: “The Blowing Insulation Symposium is the first public platform for all stakeholders. The development of blowing and injection techniques reaches a similar degree of innovation to the use of plastering machines or concrete pumps on building sites.”

Visitors to the symposium had the opportunity over the two days to learn about the different methods for the injection of blown thermal insulation materials. The audience included visitors from Russia, Chile, France, Great Britain, Latvia and Canada. Powys-based Warmcel suppliers and installers PYC Systems were in attendance.

Various demonstrations were held for different applications including on-site situations and factory filling methods. Both mobile and stationary blowing insulation machines were on show.

Seminar presentations focused on the state of blown insulation technology and its future trends. The speakers ranged from experts in fibre insulation manufacturing to building product manufacturers such as the company Hufer, which presented its Smart Six system of rafter expanders and add-on constructions.

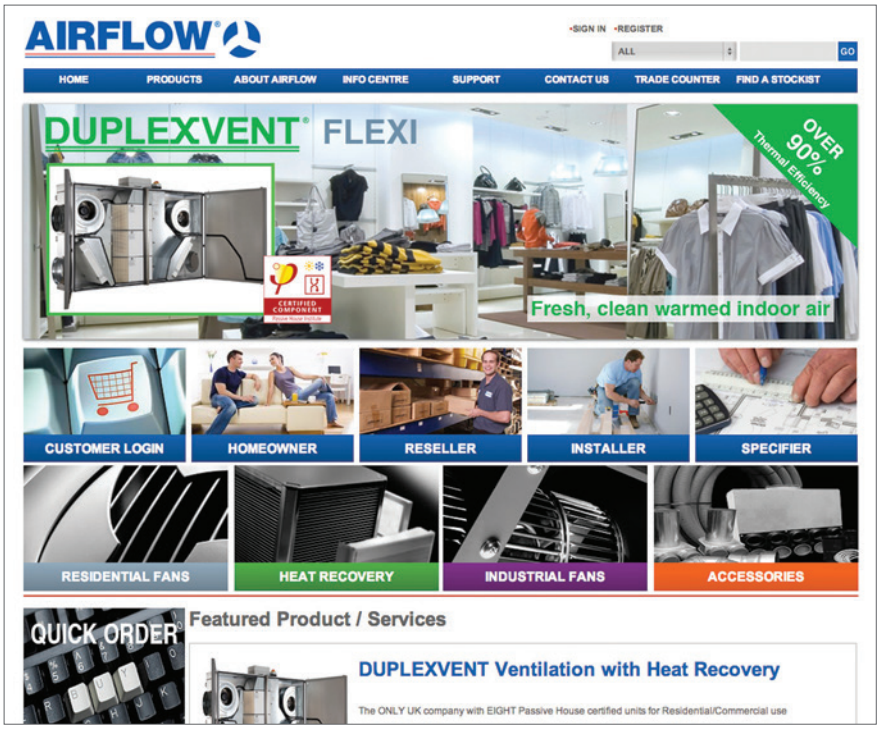
Moreover X-Floc gave all manufacturers of blown insulation materials the opportunity to present their products – 65 different products including cellulose, wood, glass, rock, sheeps wool, EPS, grass and coconut husks.

According to X-Floc the feedback was overwhelmingly positive, and the company said that for the first time stakeholders could feel a "team spirit" in the blown insulation industry. The professional dialogue was informative and enriching for all participants, according to the company, and X-Floc have said the event will be repeated in future years.

(above) A timber cassette being filled with wood fibre insulation via an X-Floc J-jet ventilated rotary nozzle

News

Airflow launches enhanced online trade counter in website revamp



Airflow Developments has launched a new website that reflects its increased range of ventilation solutions and offers a new 'quick order' facility for trade customers.

The new site takes into consideration the many needs of the UK ventilation market and demonstrates the breadth of Airflow's solutions – which includes no fewer than nine passive house certified MVHR systems under the Duplexvent range. The homeowner section looks specifically at the Green Deal and how vital ventilation is to the long-term success of highly insulated buildings. It also gives advice on what type of extraction fans meet the Green Deal criteria, so homeowners can be as informed as possible.

For the electrical wholesaler, the quick order pad function means easier placing of orders and faster turnaround time. Using predictive technology it monitors previous customer order patterns and intuitively adds their fast moving products to the order pad. This is in line with the changing ways in which the distribution market is conducting their business. John Kelly, marketing manager of Airflow Developments said: "We know our core wholesaler customers are increasingly using EDI technology both mobile and online in their day-to-day jobs, and as one of the leading UK ventilation manufacturers we have responded to this shift."

The new site also takes the increasing importance of a social presence with links to the company's Facebook, Twitter and You Tube channels, so customers can share and comment on their experiences with the customer services team at Airflow.

(above) Airflow's revamped website reflects the company's broad range of low energy ventilation options

JG Speedfit specified for passive Hanse Haus

Photo: Andy Mason

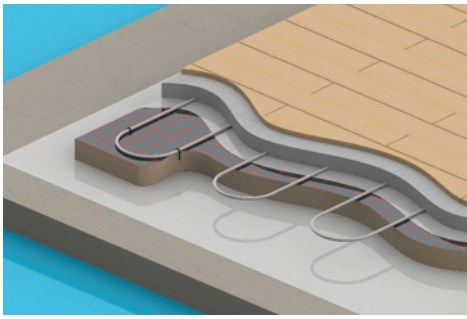
Leading pre-fabricated timber frame builder Hanse Haus recently completed their latest project featuring JG Speedfit underfloor heating – a passive house in Oddington, Gloucestershire.

The main active heating source for the 236 square metre, four-bedroom house is a ground-source heat pump. The system uses a vapour compression cycle, where pumps take low-grade warmth and concentrate it to a higher temperature that is then used to heat up the building.

Due to the low temperature flow at which the heat pump operates, underfloor heating was deemed ideal for distributing warmth throughout the house.

Being the sole plumbing and heating contractor for Hanse Haus for the UK, Synergy PHR has appointed JG Speedfit as the exclusive supplier of the underfloor heating system installed.

Darren Farley, director of Synergy PHR commented: "Since partnering with Hanse Haus in May 2012, Synergy have carried out installations in seven properties in the UK all with full ground and first floor underfloor heating by JG Speedfit. We have used both staple and over fit systems that proved to be very easy to install, saving time and effort. The co-



operation with the push-fit people was very satisfying from the initial contact with their sales representative, through to CAD specification, delivery and installation. On completion, the JG Speedfit engineers and technical support were always there to help with system setup, testing and control."

JG Speedfit assisted throughout all project stages, with a particular focus on pipe layout design and installation advice.

Farley continued: "Synergy currently have seven new jobs to complete with JG Speedfit in 2013 covering the UK, Scotland and the Channel Islands. I am looking forward to these and more successful projects in collaboration with Speedfit, using their superb products and services."

According to JG Speedfit, the philosophy behind their underfloor heating model is similar to the philosophy behind the Hanse Haus concept — innovation towards energy preservation and efficiency, comfort, aesthetics and value for money.

JG Speedfit underfloor heating offers various advantages, according to the company, including low temperature operation, simple installation, even temperature distribution, an unobtrusive and discreet circuit, multi-zoning, and compatibility with a wide range of heating technologies.

(above) The Hanse Haus passive house in Oddington features a JG Speedfit underfloor heating system

News

Pro Clima products get NBS spec clauses

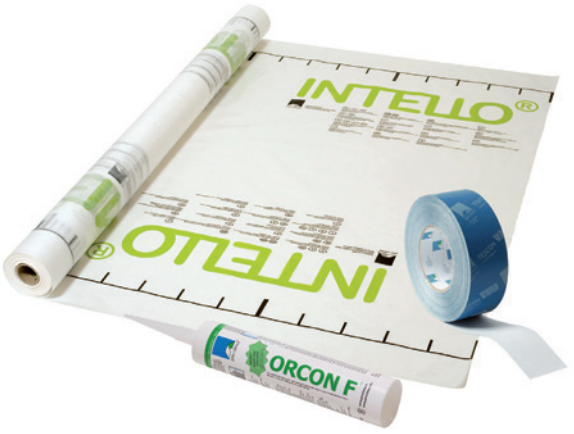
Ecological Building Systems has announced that the Pro Clima range of airtightness and windtightness building products now have NBS specification clauses.

"While it is essential to ensure that materials specified to attain airtightness are suitable and long lasting, it is also critical to provide a clear specification," says Penny Randell of Ecological Building Systems.

"Accurate specification is fundamental to the success of an airtight building project and the design stage detailing is critical to ensure that targeted air permeability rates are achieved. As passive house specifiers and designers are well aware, unless clear and precise specifications are written and then fully interpreted to the whole project team costly errors can occur if remedial work has to take place."

She continued: “The Pro Clima range has the solution for every critical airtight and vapour control junction. Gaining NBS now makes the whole system much easier to specify for architects and is just another step in our progression and commitment to working actively within the specification market.” The Pro Clima products are also featured at ribaproductselector.com

Ecological Building Systems are the sole agents for Pro Clima in the UK and Ireland, with the products sold via trained stockists.



Passive house needs greater choice – Munster Joinery

Photo: Philip Lauterbach

Market penetration of the passive house standard will be facilitated by easier availability of suitable products, a leading window manufacturer has said.

According to Munster Joinery, the market demands products that have the required performance, are affordable and meet customer expectations. “Windows and doors are a huge part of any passive build and performance, affordability and versatility are key criteria,” said Munster Joinery marketing manager Gemma Ring.

“Traditionally passive house certified windows were high on performance but expensive and offered little choice. We’re working to make the dream of the passive house build universally achievable.”

With five window ranges certified by the Passive House Institute in Germany the customer is offered a wide range of colour, material and operating system options. “The customer no longer needs to compromise on style to achieve performance,” Ring said.

The company’s passive range feature triple glazing with multiple panes of low emissivity glass and cavities filled with low conductivity gasses such as argon or krypton. Edge losses are reduced to a minimum by the use of warm edge spacer bar. All frame sections have an insulating core and are designed so as to eliminate thermal bridging at all critical points.

“Passive windows are normally a huge part of the passive spend so the competitively priced Munster Joinery offering makes the passive proposition a lot more generally accessible,” said Ring. “Munster Joinery brings the three key factors – performance, affordability and versatility to the market.”

Munster Joinery has grown since its foundation in 1973 to rate among the largest manufacturers of energy efficient windows and doors in Europe. Now operating in Great Britain, Ireland and Northern Ireland the company is a large employer with two large manufacturing plants, including a 230,000 sq ft manufacturing facility in Warwickshire and a further 910,000 sq ft production facility in Ireland. “Munster Joinery has the capacity to deliver passive products promptly,” said Ring.

According to Ring, Munster Joinery is committed to reducing its environmental impact, such as employing efficient waste management techniques to reuse and recycle waste so that only minimal amounts go to landfill. The company has invested heavily in sustainable energy solutions such as wind turbines and a CHP plant. “This gives rise to an annual saving of many thousands of tonnes of carbon,” said Ring, adding that the company’s purchasing policies favour green materials. Timber is responsibly sourced and the company has chain of custody certification to both FSC and PEFC standards.

(above) Munster Joinery’s Dublin showroom

News

Topseal gets ISO 14001 environmental certification

Leading roofing manufacturer Topseal has achieved ISO 14001 certification for environmental management. This is an international standard that provides companies with practical tools to reduce their environmental impact.

Topseal is a fibreglass roofing and waterproofing system that comes with BBA Certification and an up to 30 year guarantee. Designed to provide waterproof protection for 100 years or more, it's also available as a complete green roof system, known as Topseal GreenTop. The timber decking used with Topseal is from fully FSC-certified sources.

Topseal manufactures its core products in the UK and aims to source materials in the UK where possible too. The company's roofing materials have a BRE Green Guide A rating for domestic applications, and an A+ rating for commercial ratings.

Topseal can be installed for regular roofs, green roofs, balconies or walkways, and even pools and ponds.

"Topseal GRP can be designed to practically any size and shape," Topseal's Vicki Smith told Passive House Plus. The product is installed through a national network of trained and approved installers.

Topseal also has ISO 9001 quality management certification. The product is applied without the need for heating, helping to make installation safer and more energy efficient. It is also recyclable once its service life is finished, and is compatible with roof mounted wind turbines, solar panels and roof lights.

(above) The Topseal Green Top green roof system

Leading care home designers launch new passive house firm

Leading designers of care homes and extra care flats The Tooley & Foster Partnership have launched a subsidiary, Accredited Passivhaus Design, to provide passive house design and energy calculation services. The firm's goal is to help designers create buildings with deliverable low running costs and great comfort for residents.

Certified passive house designer Peter Ranken says that building to the passive house standard is ideal for care homes, as comfort and low energy use is included for the lifetime of the building without relying on bolt-on technologies. "This is a win-win for residents and building managers – with filtered air, no draughts and even surface temperatures, residents don't have to worry about getting too cold or too hot," Ranken said.

"For the care home operator, heating bills are minimised, and future upgrades to cope with rising fuel bills are not necessary. The extra cost of building and certifying to the passive house standard can be offset by reduced bills in about eight years, or less if fuel costs continue to increase."

Unlike most houses, care homes and extra care flats are occupied and heated 24 hours a day to keep internal temperatures comfortable for frail residents. With conventional care homes this can give very high running costs, as the heating is turned up to compensate for draughts and low surface temperatures. The passive house approach designs out these problems.

According to Ranken, Passivhaus Design sees the adoption of the passive house standard as essential to meet four future challenges: demographic change with increasing numbers of elderly people, future fossil fuel shortages, legislation to reduce carbon dioxide emissions, and cost certainty with reduced running costs.

"Our past experience of 'bolt-on' eco technologies shows that they can be unreliable and do not deliver the energy and fuel savings promised, Ranken said. "Passive house is more robust and we can confidently recommend it to our clients."

(above) An illustration of an Accredited Passivhaus Design extra care scheme in the Cotswolds designed to the passive house standard

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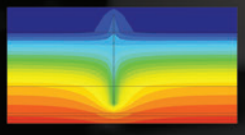

BRE Competency: modelling construction details and so determine their linear transmittance Ψ, and temperature factor f. to BR497

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Speak to any one of our qualified Technical Team members
We're here to help!

News

Passive house consultant designs low impact lamp

What do passive house consultants get up to in their spare time? In the case of Nick Grant, it's ecological industrial design.

One of the leading lights in the UK passive house sector, Grant has teamed up with artist-metalworker Colin Chetwood to design and manufacture Lock Lamp, a low environmental impact task light created with the aim of combining aesthetic appeal and practical design.

The hand crafted lamp was designed to comprise minimal materials; steel, nickel, birch ply and aluminum combined to achieve a slim product that has both strength and flexibility.

The lamp's positioning mechanism has been designed with ease of operation in mind. The light is extended, raised and rotated about two axes and is locked into place by gravity, without the use of springs, counterweights or screw clamps. It is designed specifically to work with bulky and heavy energy-efficient lamps including CFLs and LEDs.

Grant and Chetwood first worked together to design the light fittings for award-winning passive house architects Architype. Their frustration with available task lighting options led to the creation and development of Lock Lamp in their Herefordshire workshops.

Further information on lighting from Grant and Chetwood is available from www.locklamp.com

(above) The MK2 lamp features a steel base and ply shade; the LED desk lamp (inset)

Wolfgang Feist to speak at See The Light 2013

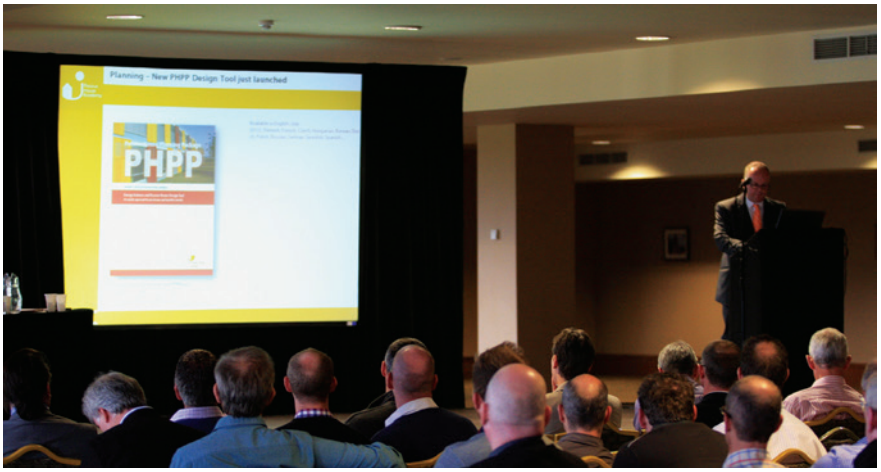
The Passive House Association of Ireland has announced that Passive House Institute founder & scientific director Prof Wolfgang Feist will be the keynote speaker at this year's annual 'See The Light' Irish Passive House Conference.

The event will take place on Friday, 25 October in Dublin Institute of Technology, Bolton Street.

The PHAI said the visit of Wolfgang Feist will provide an excellent opportunity to run an academic stream for papers on the topic of passive house and low energy buildings research in Ireland.

"The event will provide the passive house community with a setting in which to showcase its research," said PHAI chairman Martin Murray. "It will also provide a forum to showcase opportunities for further co-operation in passive house research in Ireland."

Half page abstracts are sought by the first week in September to enable the committee to select topics for presentation, and all topics are open for consideration. Potential topics to date include: passive house education at second and third level in Ireland, passive house and thermal bridge analysis, passive house and hygrothermal analysis, suitability of the building stock for energy retrofit, and seasonal thermal energy storage in combination with heat pumps.



For further information see www.phai.ie

(left) Passive House Academy founder Tomás O'Leary announcing the release of a new version of the Passive House Planning Package (PHPP) software at See the Light 2012

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Floor area (approx. ft² or m²): _____

Budget (approximate): _____

Stage (tick box)

Initial appraisal ☐ Pre planning ☐ Planning approved ☐ Pre tender ☐
Commencement notice ☐

Project imperatives (tick box)

Certified passive ☐ Near passive/low energy ☐ Indoor air quality ☐ Low running costs ☐
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Other (please state): _____

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I would like my project to be considered for feature in Passive House Plus (tick box) ☐

Will nearly zero energy buildings result in a thermal comfort deficit?

As the UK inches towards zero carbon and nearly zero energy building targets, the construction industry must pay increasing attention to the impacts of regulatory changes on design and construction, argues Passive House Academy founder ***Tomás O'Leary****. But will homes designed using the UK's national methodology come close to passive house levels of comfort?*

As many Passive House Plus readers are aware, Part L1A of the building regulations deals with energy efficiency and renewable energy requirements for new dwellings and is the British government's key reference document guiding England and Wales towards meeting their 2020 carbon commitments. The building design and construction community need to know this document along with the various energy modelling programmes in order to achieve compliance. An updated version of Part L1A was introduced in 2010, at a time when activity in the construction sector hit an all-time low and when many designers and contractors may have been out of touch on exactly what's required of them. In addition to knowing what's included in Part L1A, it's also critical to know what's excluded in terms of everyday comfort attainment and real energy consumption.

> "If serious progress is to be made towards achieving nearly zero energy buildings in the UK by 2020, U-values have to reduce significantly."

The U-values required in the UK are significantly lagging behind those required in its nearest neighbour, Ireland – in some cases by as much as 42%. The backstop U-values in England/Wales and Ireland respectively are 0.20 and 0.16 W/m^{2}K for roofs, 0.30 and 0.21 W/m^{2}K for walls, 0.25 and 0.21 W/m^{2}K for floors, and 2.00 and 1.6 W/m^{2}K for windows. If serious progress is to be made towards achieving nearly zero energy buildings in the UK by 2020, these U-values are going to have to reduce significantly over the coming years. There's also considerable room for improvement on airtightness levels required in Part L1A, currently standing at 10m^3/hr/m^2 compared to a marginally better 7m^3/hr/m^2 in Ireland.

A recent study by the Passive House Academy modelled three house types typically found in Ireland in the Deap software – the Irish equivalent of Standard Assessment Procedure (Sap) 2009 used in the UK – to explore different routes to energy efficiency compliance. The study used a 127 sq m bungalow, a 151 sq m two-storey detached house and a 114 sq m semi-detached house and applied multiple scenarios which included what we labelled 'backstop house', 'high-performance envelope house' and 'heat pump house'.

In the backstop house, we modelled all the minimum backstop values for insulation, windows, airtightness and renewable energy and used a gas boiler as the heating source. In all three cases, the houses failed to meet both the energy efficiency and carbon emissions requirements – which in Ireland both stand at 60% reductions compared to our 2005 building regulations. So if you're using a traditional heating system such as gas or oil, the backstop U-values listed above come nowhere close to compliance. I wonder just how many designers and builders in Ireland are aware of this.

Next we modelled our high performance envelope scenario to see what would be required for compliance if using a boiler and found that near passive house levels of insulation and airtightness would be needed for all three house types, with U-values of 0.13 for opaque elements, 1.2 for windows and doors and an airtightness of 1.0m^3/h/m^2). From a detailing and construction perspective, achieving compliance in this case is considerably more challenging than would be required with just the backstop values.

Our next analysis swapped out a traditional boiler for a high-efficiency (COP of 4.44) electric heat pump and, to our surprise, compliance could be achieved for all three house types with just the backstop values for insulation, airtightness and renewable energy (Ireland's regulations for new homes mandate a renewable energy contribution of 10 kWh/m^2/yr thermal energy or 4 kWh/m^2/yr from microgeneration). It seems that the choice of heating system thus trumps insulation and airtightness levels in terms of compliance, and that a leaky building with modest levels of insulation is an acceptable form of construction in 2013.

I can't help but wonder whether the energy efficiency regulations in the UK are falling short on ensuring thermal comfort for building occupants. The set temperature in Sap 2009 for living spaces is 21C and just 18C elsewhere. The Passive House Academy recently modelled nine different dwelling types commonly built in Ireland and worked out the average temperature for each dwelling using the above temperature requirements. The proportion of living area ranged from 9 to 35% across the nine buildings, and the overall average whole-house temperature provided for emerged at 18.5C. This falls considerably short – by 1.5C – of the whole-house temperature required in passive house. At first glance that temperature difference between Part L1A and passive house might not seem much, but when you consider that the latter also ensures warmer surfaces (achieved through better U-values in opaque elements as well as windows), greatly reduced thermal bridges and some 20 times better levels of airtightness, the comfort levels provided by the two approaches are, frankly, worlds apart.

Let's consider next the duration of time that the above average temperature of 18.5C is 'required' in the dwelling. During weekdays in the heating season, it's assumed that the house is heated for just eight hours per day, doubled at the weekend to 16 hours to reflect the likelihood that occupants are at home for longer periods. It strikes me, however, that there are vast numbers of households where 18.5C for just eight hours per day is far removed from the thermal comfort requirements of real families in real houses. In other words, I suspect that the building's EPC in many cases will not be a true reflection of either comfort levels in the dwelling or actual energy bills – or, most likely, both. Incidentally, comparing the heating period duration

“I can’t help but wonder whether the energy efficiency regulations in the UK are falling short on ensuring thermal comfort for building occupants.”

in the UK and Ireland unearthed a curious anomaly insofar as sixteen hours at the weekend is assumed in the former, compared to eight hours in the latter. This difference, if borne out in reality, would amount to considerably higher energy consumption in the UK compared to Ireland. My own expectation, however, is that the thermal comfort expectations is similar in both countries and that the UK energy modelling approach is more plausible. The time and temperature settings for heating in passive house are far more predictable and, for me, more representative of what’s needed in reality – namely 20C, 24 hours per day, 365 days per year.

As a very fortunate resident in a passive house since 2005, I’m often asked whether 20C is warm enough in the cold winter. Behind this question is, I can only conclude, an admission on the part of the enquirer that such a temperature in conventional dwellings falls below par in terms of thermal comfort. The design temperature of 20C in a passive house is the operative temperature, an average for both air as well as surfaces. If you live in a conventional dwelling where the air temperature is 20C but the surface temperature of glazing is, say, 14C, temperature stratification will result and comfort will be impaired.

In my view, therefore, the time and temperature assumptions in Sap, if followed precisely, would result in what might be referred to as a comfort deficit.

Another fact that that has puzzled me for quite some time is that just one climate data source is used to model the energy balance for dwellings across England and Wales. In Sap 2009 the location of 53.4ON is used to model solar gains for example, equivalent to Liverpool. But what if you’re located considerably further north or indeed south of Liverpool? Surely the solar gains in Plymouth, some 250 miles to the south would be significantly more, contrasted with Newcastle to the north which would be somewhat less. Sap also refers to just one set of monthly external reference temperatures for England and Wales, which has a very significant bearing on transmission and ventilation losses. Compare this with passive house which has over 22 detailed climate datasets for the UK.

So what can we learn from the above review?

All European nations are on the road towards what’s referred to as ‘nearly zero energy buildings’ by 2020 (by the way, I think it’s quite hilarious to include the term ‘nearly’ in a European policy directive – don’t you?). But the process and programmes by which we quantify the energy consumption of dwellings are, in my opinion, rather blunt instruments and the comfort deficit highlighted above will almost certainly guarantee that the real energy consumption (and carbon emissions) of your dwelling will be considerably higher than that suggested on your energy label. So-called ‘nearly zero energy buildings’ of the future might actually be far from that in reality. The variances in energy modelling methods used in different European countries is also regrettable in my view and will prevent us knowing whether a ‘nearly zero energy building’ in Ireland bears any relation to one in the UK or Denmark.

Part L1A and Sap are the building rules by which everyone must abide – in that respect this system is fair insofar as it provides a level playing field. I have a strong suspicion, however, that the design, construction and home-owner community are not fully aware of what exactly is included or excluded in the game, however, and the sooner we all get up to speed the better. If we continue on the current path, the claim in Europe that we live in nearly zero energy buildings will smack of the Emperor’s new clothes.

My own preference would be to adopt a system which uses a scientifically rigorous approach right across Europe (or the world for that matter) and which has a proven track record in delivering high comfort no matter what the climate. It’s sitting there on the shelf and is called passive house.

Passive house is already mandated in the city of Brussels from 2015 – the very city that is home to the European Commission which issued the Energy Performance Building Directive and the call for nearly zero energy buildings. Isn’t that more than just a little ironic?

Follow us on Twitter and tweet your thoughts to @phplusmag

Here’s a sample of our recent tweeting, along with tweets and threads of tweets that caught our eye.

CPWSeattle @CPWSeattle World Bank reports that today’s energy use would be 36% higher without efficiency gains of the last 20 yrs.

Paul Price @swimsure @CPWSeattle Efficiency good but carbon intensity of global GDP is unchanged in 35 years. Efficiency 'savings' are spent on CO2!

TreeHugger.com @TreeHugger Just thrilled to discover new mag on Passive Houses @phplusmag, so much to steal! http://goo.gl/u2LbE

Lenny Antonelli @lennyantonelli Thanks to @lloydalter for plugging my blog post for @phplusmag on 'passive house vs passivhaus' at @treehugger yesterday http://goo.gl/u2LbE

Passive House Plus @phplusmag Unbelievably, we've had 4 UK enquiries in today on projects worth a combined £228 million! #passivehouse #passivhaus #greenshoots

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Munish Datta @MunishDatta Unique building block made of recycled materials captures more carbon dioxide than is emitted during its manufacture http://ow.ly/1ZolZy

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Passive House Plus @phplusmag UK govt plans: allow carbon offsets in supposedly zero carbon homes, as explained by @EnergistUK http://bit.ly/1eRCfyG #allowablesolutions

Passive House Plus @phplusmag What would it look like if the UK govt used its #allowablesolutions approach for "zero carbon" homes in other policy areas?

Passive House Plus @phplusmag EG don't push industry to green production. Shut ‘em down, buy imported goods & the carbon is another country's problem! #allowablesolutions

EU vote to keep carbon costs low hurts the environment – & industry

The collapse in prices for carbon permits since the global financial crisis has led many to question the design of the EU's Emissions Trading Scheme. According to ***Andrew Warren****, director of the Association for the Conservation of Energy, a recent EU vote is set to keep prices low into the future – while disadvantaging industry in countries where higher carbon floor prices have been set.*

The headlines are screaming. The EU:ETS – the European carbon emissions trading scheme – is in an "existential crisis". According to the Economist magazine, its allowances are now "below the level of junk bonds". A New York Times editorial crows that Europe has conceded its leadership role on climate.

The "crisis" has been caused specifically by the European Parliament's decision to reject by just 19 votes a proposal to remove temporarily some of the oversupply that has overwhelmed the market for permits to emit carbon dioxide.

"Multinational heavy industry lobbied against the principle of changing the rules mid-game."

Conversely you could argue that the scheme is meeting one of its main goals. It was launched in 2005 as a cap-and-trade system, with the intention of setting an absolute limit upon the total amount of emissions across the European continent emanating from power stations and from heavy industry.

This is precisely what has been achieved. It may not have changed attitudes to industrial energy efficiency. Or even the merit order for electricity plant. But at least in one way the EU:ETS is a cause for celebration. After all, when initially conceived at the start of the century, few external observers outside Europe thought that 28 countries could really co-operate so effectively, to ensure almost total compliance with inventories and assessments. On the back of it, a whole new breed of carbon traders emerged.

The traders' commercial interests ensured that genuine free trade of allowances across national borders could, and did, take place. In the initial months, trading prices were recorded of around 35 euros per tonne of CO_2 emitted. Today the price has fallen to less than one-tenth of that figure. Indeed, with the marketplace moribund, trading desks are losing staff fast.

What went wrong? The simple answer is: the fault wasn't with the trade. It was with the cap. The cap has simply been too generous. Up until this year, it was the role of each sovereign government to decide how many allowances were distributed to their heavy industry. Some (including the UK) were pretty strict. Other governments were not. This matters in a system where an allowance bought in Prague or Rome had the same worth as one bought in London or Stockholm.

Over-supply was already obvious when the banking crash took place. Given a decline in demand for heavy industrial activity, their need to hold quite so many allowances diminished, much as their requirement for liquidity grew. Many permits changed hands, moving from heavy industry to electricity generators at ever decreasing prices.

Why did the generators want to own as many allowances as possible? Because although initially permits were given away free to participants, increasingly the generators in particular were being forced to acquire theirs via auctioning. And allowances have no expiry date. Once obtained, they can be held in reserve until needed.

With more and more allowances flooding into an already over-supplied market, the law of supply and demand led to the exponential price collapse. The motion defeated in the European Parliament had been intended to hold back 900 million allowances for six years, in the hope of stabilizing prices.

It did not succeed, because multinational heavy industry lobbied against the principle of changing the rules mid-game. For obvious reasons: they prefer lower prices. This vote effectively reduces the trading system itself to a minor nuisance, as trading prices are forecast to stay at or around £2.25 per tonne for the rest of the decade.

Many free market commentators celebrated. That is certainly not how most of British industry perceives it. Few commentators understand that, from last month, it is irrelevant to those manufacturing in Britain what the EU:ETS trading price is elsewhere in Europe.

For British manufacturers the effective trading price is £16 per tonne this year, increasing each year subsequently. This is because the chancellor has unilaterally introduced a "floor price for carbon", which ensures there is a minimum price paid in Britain, regardless of the trading price on the continent. The lower that traded price, the more the extra differential between the prices paid in Britain and those elsewhere in Europe. And the more British industry is placed at a competitive disadvantage.

It is a point that the government was making very plain to all UK MEPs. Practically all Liberal Democrat and Labour MEPs listened. In contrast almost the entire 25 strong contingent of Conservative MEPs – with four honourable exceptions – voted to increase the differentials between UK and continental prices, to the UK's detriment. Had they voted as the government requested, the proposals for backdating would have passed, with the relative damage to British industry reduced.

The saga may not be over. Later this summer the European institutions are set to consider alternative options to reinvigorate the trading scheme. There is a determination amongst many (although far from all) European governments to make the scheme work. But it will not be easy.

I fear that some of those rejoicing took delight in doing down anything concerned with helping the environment. Whether they are equally pleased with deliberately decreasing business opportunities in Britain, it is nonetheless what these ill-informed cheerleaders have achieved. This is no time for celebration.

Photo: European External Action Service

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INTERNATIONAL SELECTION

Virtually any building, anywhere can achieve certified passive house status, as these four transatlantic buildings show – including a Viennese skyscraper, an upgrade to an NYC home predating the Empire State Building, a German museum housing valuable works of art and a net zero energy home in New Mexico.

Photos: Fabrica718

Tighthouse, New York City

Here's a surprising fact: the first certified passive house in New York City was built in 1899. This retrofit of a derelict row house surpassed Enerphit, the Passive House Institute's retrofit standard, and boldly aimed for full certification.

Architects Fabrica 718 and passive house engineers Zero Energy Design decided to insulate the walls and roof both externally and internally to reach the required performance.

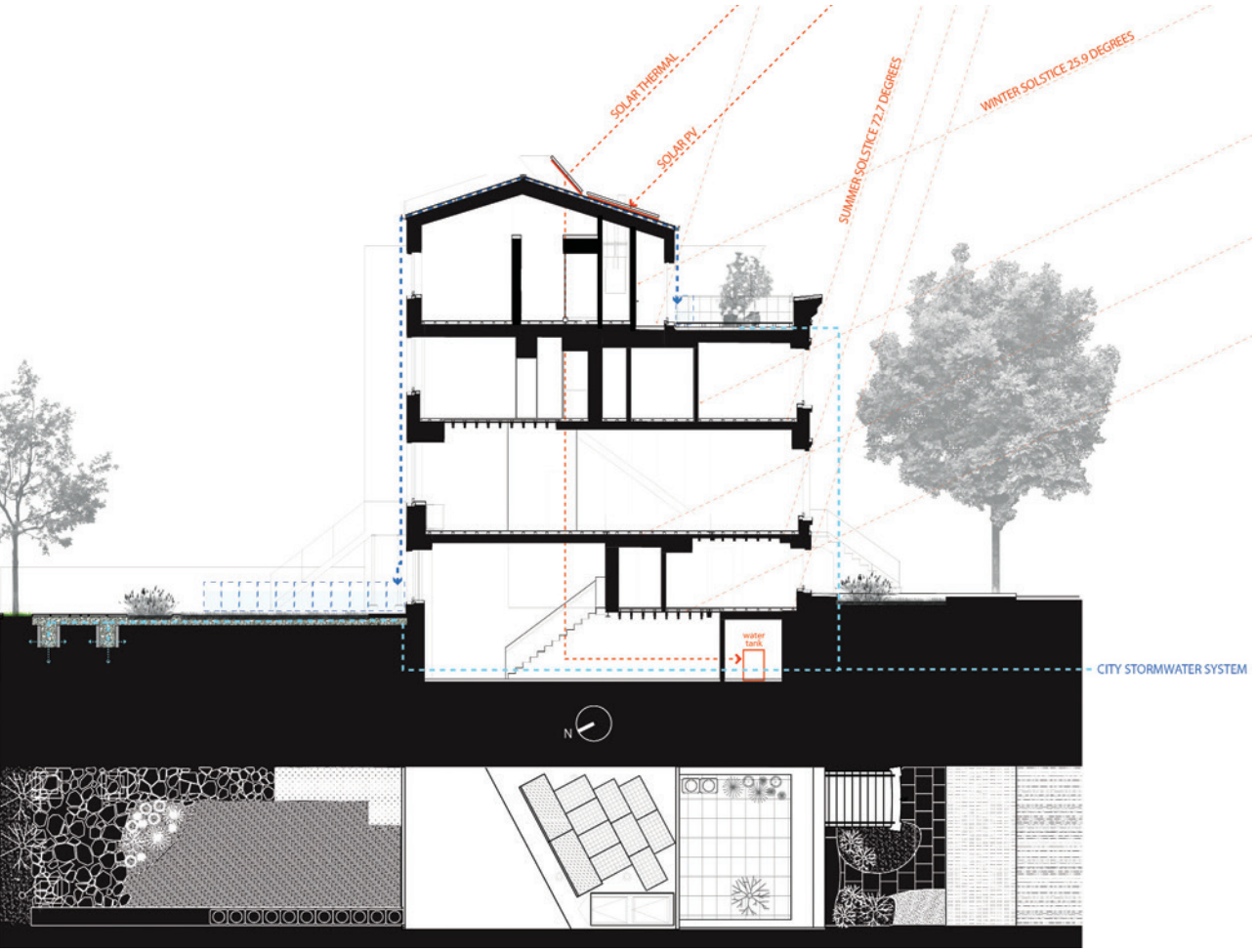
"We definitely were convinced by exterior insulation and were lucky that the building wasn't landmarked so we could actually use the exterior insulation," says architect Julie Torres Moskovitz. "We actually achieved our airtightness with [external insulation] combined with some critical membranes."

Spray foam insulation was used on the walls and roof internally. "We used open-cell spray foam, which is vapour permeable and will allow drying to the interior," says Jordan Goldman of Zero Energy Design.

The green agenda here is about more than just energy efficiency though: rainwater collection, solar thermal and photovoltaics also feature. The architects say the house – which was certified by Irish passive house pioneers Tomás O'Leary and Art McCormack of the Atlantic-straddling Passive House Academy – needs 90% less heat than a typical dwelling.

"We have been monitoring the house carefully for about 9 months...and making various tweaks along the way," Julie says. "Once we have 12 months of data — covering us through a complete heating and cooling season — we will have a lot more specific data on the home's performance. The home is doing very well now though and the owner is thrilled."

Having designed NYC's first certified passive house, Julie Torres is taking the passive house gospel to the world — Princeton Architectural Press has just published her book The Greenest Home: Superinsulated and Passive House Design. ▶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Photos: Manfred Burger/MVAHA

RHW.2 tower, Vienna

Tall buildings tend to be among the worst environmental and energy offenders – but one new Viennese project shows that high rise doesn't have to mean high environmental impact.

Few buildings symbolise the transition from oil age profligacy to environmental responsibility as well as Vienna's RHW.2 office tower.

From 1965 to 2009 the site housed the headquarters of OPEC (The Organisation of Petroleum Exporting Companies). That building's now been replaced with the tallest building in the world to achieve passive house certification. Perched on the bank of the Danube canal, the glazed facade of RHW.2 rises almost 80 metres high. The 21-storey building is home to 900 employees of the Austrian Raiffeisen-Holding banking group, and also houses a kindergarten and public café.

"This building proves once again that the passive house standard and good architecture are perfectly compatible," says Prof Wolfgang Feist, director of the Passive House Institute.

The tower's heating and cooling demand was reduced by 80% compared to conventional high-rise buildings. A photovoltaic array and geothermal heat pumps help to meet the building's electricity and heating demand respectively, but the bulk of the building's energy is supplied by a biogas-powered combined heat, cooling and power plant. Even waste heat from the data centre is re-used, with cooling partly coming from the Danube canal itself.

Cool water from the canal is circulated via pipes embedded in the building's concrete frame. The building also features a twin façade, consisting of triple-glazing in the building's thermal

envelope sitting inside a glazed façade. In addition to reducing the risk of glare and overheating, this design gives the building another advantage over typical high rises: windows can be opened without fear of the wind wreaking havoc inside.

The building's green credentials go beyond passive house certification – RHW.2 scored close to a perfect score of 949 out of a possible 1000 points in achieving a gold rating under the ÖGNB (Austrian Sustainable Building Council) quality label.

In July, the RHW.2 tower's passive house certificate was presented by Susanne Theumer of the Passive House Institute on the 20th floor of the tower, overlooking the old city of Vienna.

The project cements Vienna's status as a passive house pioneer, with the city's new residential Eurogate passive house district currently under construction and due to be completed next year. ►

(above) Streetview of the VOLKsHouse, a net-zero energy home that the architects say costs 6.5% less per square foot than a similar conventional home and establishes new standards for affordable housing

(below) view of the northeast corner of the house and the slanted living room wall. The second floor roof-deck, located over the living room, allows the residents to enjoy the distant mountain view in absolute privacy.

VOLKsHouse, Santa Fe, New Mexico, 2012

Photos: Amadeus Leitner / Drawings: MoSA

Architects MoSA didn't just design a passive house, they claim to have built a net-zero-energy home that costs 6.5% less per square foot to build than a typical dwelling.

Another building that was certified by the Passive House Academy, the VOLKsHouse also gets an Emerald rating — the highest available — from the National Association of Home Builders.

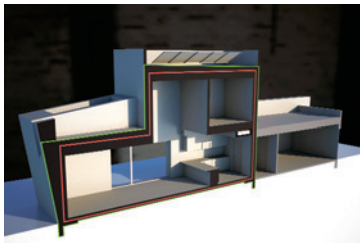
This timber-frame home boasts 250mm of EPS wall insulation, triple-glazed Optiwin windows and doors, plus solar thermal panels and photovoltaics. And it smashed the passive house airtightness standard with a pressure test result of just 0.3 air changes per hour (the requirement is 0.6). A layer of structural OSB boards within the timber frame structure provides the airtight layer.

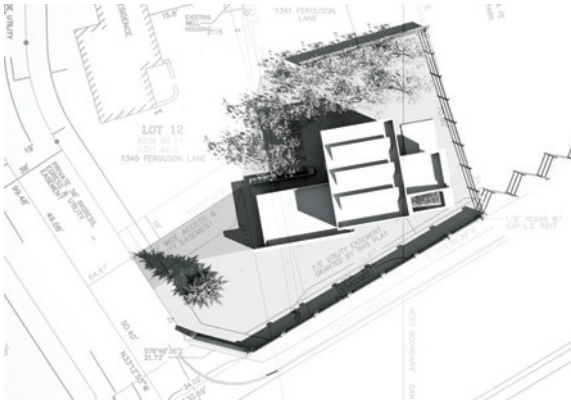
To avoid thermal bridging between the two structures, the house's garage is set ten inches away from the main dwelling.

Energy consumption and bills are now being monitored to verify savings. Architect Jonah Stanford says on the project website, worldecohouse.com, that one of the key ways to keep passive house construction cost down is to focus on simplicity.

"If you find that the systems are getting complicated then stop, and think about how you got there," he writes.

He also says: "VOLKsHouse sets a baseline for driving down construction costs, serves as a model for training and educating builders, establishes new standards for affordable housing, and unlocks economic potential for the expansion of green living and eco-construction. If a passive house uses far less energy and costs less to build, there's no longer any reason to build anything else." ▶





Photos: Roland Halbe / Herz & Lang

Museum of Arts, Ravensburg

Words: Lenny Antonelli & Stephen Quinn

The world's first certified passive house museum opened in Ravensburg, Germany earlier this year. The museum houses the private art collection of advertising executive Peter Selinka, who died in 2006, and his wife Gudrun. Their collection features works of German expressionism and the avant-garde COBRA movement.

The external walls are constructed from a cavity wall system: on the outside, 200-year old bricks recovered from a demolished monastery, and behind this 240mm of mineral wool insulation, followed inside by concrete blocks.

"The greatest challenge was the small number of windows," says Florian Lang of Bavarian firm Herz & Lang, who were responsible for passive house planning and certification on the project. Artwork cannot tolerate natural light and is best displayed under artificial lighting, but this reduces the building's solar energy gains. However, internal heat gains from visitors to the museum help to compensate. "The passive house principle of keeping the heat inside the building turned out to work extremely well in this context," says Lang.

The building was designed by Stuttgart architects Lederer Ragnarsdóttir Oei and built by construction firm Reisch.

Some of the building's components had to be re-thought to meet the passive house standard. Cavity wall brackets with minimal steel content were developed to cut thermal bridging across the wall cavity, while the team even came up with a new Passive House Institute certified revolving door for the entrance.

Passive House Institute founder Dr Wolfgang Feist says this is a typical example of how the low energy standard can drive innovation.

"The passive house is an innovation engine. In particular small and medium businesses have always met the challenges head on and developed many new and improved 'made in Europe' products, which have significantly improved energy efficiency," he says.

"I very much hope that the museum in Ravensburg becomes a model for many other projects of this kind."

Heating and cooling — plus humidification and dehumidification — takes place via a ground source heat pump paired with a gas absorption heat pump. Conditions in the exhibition rooms must be kept very close to 20C and 50% humidity throughout the year.

"In the end, it turned out that passive house was the perfect solution for the high indoor environmental quality necessary for these valuable pieces of art," says Florian Lang.

For further information please visit: www.passivehouse.ie

Stephen Quinn is a civil engineer with Herz & Lang.

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Lancashire housing scheme

banks on passive

Back in 2004, a group of green-minded friends tried to buy a disused school and turn it into a communal home. The project never came to fruition, but it was the starting point for Forgebank, a cohousing development of 41 passive dwellings in Lancaster. Not only is Forgebank one of the UK's flagship passive house projects, it's a bona fide eco-community.

"One of the things we wanted to do was build more sustainable housing," says Jon Sear, one of the original group of friends. When the time came to build, he acted as the community's full time project manager.

Cohousing is a type of intentional community, where private housing is supplemented by community facilities. Residents live in normal homes, but have a communal kitchen, dining room, laundry, offices and outdoor spaces.

If they were to make this community a reality,

Photos: Luke Mills/Lancaster Cohousing/Eco Arc

The winner of the Social/Group Housing award at the 2013 UK Passivhaus Awards, Lancaster Cohousing's Forgebank development in Lancashire is riddled with green features. Not only are all of its 41 homes passive house certified – it scores top marks in the UK's Code for Sustainable Homes too.

Words: Lenny Antonelli & Jeff Colley

the group would first have to overcome an obstacle familiar to many sustainable projects: finance. "There were a few difficulties, for instance finding a bank willing to give us a loan when we weren't an established developer," group member Alison Cahn wrote in a 2011 article in the Guardian. "Eventually Triodos Bank came to our rescue."

But this development finance hinged on the group finding a lender willing to offer mortgages for individuals within the cohousing structure. Pioneering green mortgage lender the Ecology Building Society bought into the group's vision.

Because each property – and occupant – is an integral part of the cohousing community, securing such finance can be problematic, with lenders put off by the complexities of such a project.

For Ecology – with its years of experience lending to members of cohousing projects and other ownership structures that encourage shared resources and low impact living – this wasn't a problem. The lender even came with an added bonus: their C-Change mortage includes a 1% discount off their standard variable rate on all homes built to the passive house standard.

The original group had more than doubled when it came time to buy land. Leading green design firm Eco Arc were appointed as project architects.

"There was a great synchronicity between what they wanted to do and what we wanted to do," says Andrew Yeats, principal architect at Eco Arc.

Andrew had previously spent more than twenty years as resident architect at the pioneering Findhorn eco village in Scotland, and had undertaken a 3,000 mile bike trip to Scandinavia to study cohousing. His partner Lucy Nelson, the other principal at Eco Arc, had also spent time studying cohousing in Scandinavia and America. Eco Arc even moved their offices across England, from York to Cumbria, to be closer to the project.

The firm had produced feasibility studies for various sites before the group eventually bought a six acre brownfield site on the steep banks of the River Lune near Halton village, three miles from Lancaster city.

The group took a risk and bought the site at a knock-down price, without having secured planning permission.

The plot was part of a larger site once home to Halton Mill, which manufactured oil cloth and was built in the 19th century. Major demolition, remediation and site stabilisation work was needed before construction could begin. "It was a really difficult site to develop," Andrew Yeats says.

Unlike most construction projects, he says that planning a cohousing development requires a participatory, consensus-led design process among the whole community.

"We did one weekend a month with the first 30 householders. We went through everything from choosing a site, to site organisation, to picking the front doorknobs. We did everything together. I think it went exceptionally well, and that's partly because we're reasonably well experienced in that genre."

By the time preferred contractor Whittle Construction was appointed, the initial design had been done. The contractor then met regularly with the whole design team for 12 months prior to starting on site to thrash out a workable detail design.

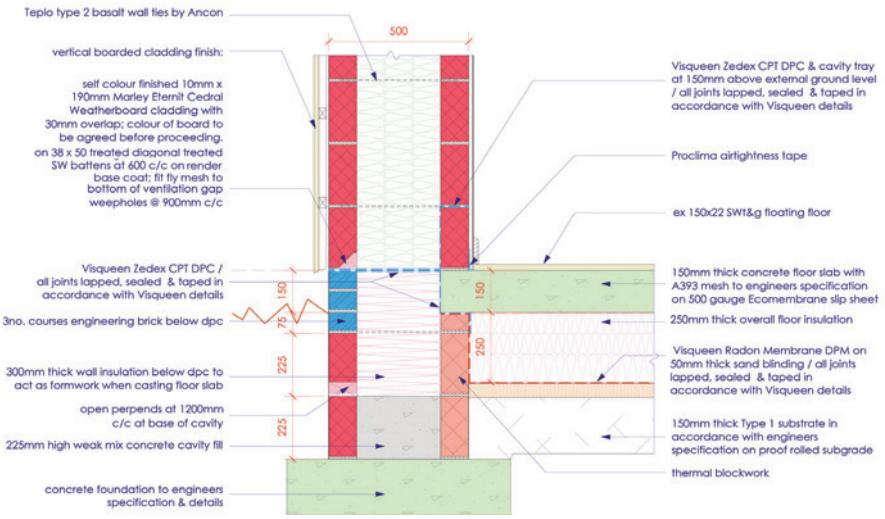
"These project meetings enabled us to understand the philosophy of the client and their design team to achieve Code for Sustainable Homes Level 6 and passive house accreditation," Whittle MD Graham Bath told Green Building magazine in Summer 2012. "Whilst we had carried out various schemes for housing associations throughout the Northwest to CSH Level 4, the project brought new and exciting challenges, particularly due to the utilisation of masonry construction, rather than the more usual timber frame or prefabrication solutions."

The site features 41 homes across seven terraces, ranging from one-bed flats to three-bed houses, including 7 "upside down" three-bed units – where the living room is on the first floor and bedrooms on the ground floor. Thirty-five of the units are part of the cohousing community (one terrace is private housing outside the community setup).

As part of the design brief, all 41 units had to achieve passive house certification — this was because, Andrew Yeats says, it's a "robust and unquestionable" standard that would verify the energy efficiency of the homes. "It would be unchallengeable," he says.

Eco Arc came up with eight different possible wall build-ups, but cavity wall was ultimately chosen. Not only was it the cheapest option, it was also the one contractor Whittle Construction was most comfortable with.

The inner and outer leaf were both built with Enviroblock, which is produced in the UK by Aggregate Industries from recycled and secondary concrete aggregates. The 300mm cavity is fully-filled with Knauf Earthwool DriTherm glass wool insulation – and 300mm Springvale Platinum ▶



A ground floor wall detail reveals the attention to insulation continuity and reduced thermal bridging; (below, left to right) 300mm graphite EPS in base of walls, Teplotie wall ties & Celcon inner leaf beneath DPC; Enviroblock walls with 300mm Knauf Earthwool insulation; (p37, clockwise from top) the sedum roofed common house; a 150kW Herz biomass boiler heats the development via district heating; Celcon blocks installed from eaves to roof apex to reduce cold bridging; south elevations with Kerto timber frame panels.

Floorshield insulation beneath DPC level, and features thermal bridge free TeploTie basalt wall-ties too. Aerated Celcon thermal blocks were used to reduce thermal bridging at several key junctions – including sub-floor walls and from eaves to roof apex, and to form innerleaf at end of terrace walls.

Super-wide cavities might seem like a relatively new phenomenon in the era of energy efficient building, but Eco Arc first used this detail in 1992.

Passive house consultants Alan Clarke and Nick Grant were brought in to model and optimise all thermal details in Therm, going through many iterations to optimise cost using PHPP as a design tool, with Clarke providing site support, including ongoing thermal imaging to catch potential issues during construction.

The south elevations of each terrace are heavily glazed to maximise solar gain, but because the opaque sections here are so small, timber frame was chosen over block. The Kerto structural timber frame system is insulated between the studs and externally with Pavatherm Plus woodfibre insulation and clad outside with Marley Eternit Operal and Cedral cement fibre-boards.

Under the ground floor there's traditional strip foundations with 250mm of EPS insulation below the concrete slab, which contains GGBS, a recycled alternative to traditional portland cement.

Upstairs, the roofs of seven of the units are insulated with 350mm of Knauf Perimeter Plus loose glass wool insulation between the rafters in seven units. To reduce cold-bridging there's Gutex woodfibre board over the rafters, and the roof insulation zone is continuous with the cavity wall insulation zone to ensure a continuous thermal wrap. This vaulted ceiling approach was dropped for the remaining 34 houses on cost grounds and replaced with a bob-tail truss used instead of a vaulted ceiling, and 500mm of Knauf Loft Roll insulation laid horizontally at ceiling level. Beneath this, no cavity closers were used, in order to ensure a continuous insulation layer.

According to Nick Grant, the roof detail, as well as ground floor and wall details were heavily influenced by the details for Denby Dale[1] – the UK's first cavity wall building to achieve passive house certification – as well as details in the AECB's Gold standards. "The Green Building Store put out a lot of free information for people to use," says Grant.

The wet plaster internally serves as the airtight layer on block walls, with Pro Clima Intello membranes in the timber frame elements, and Pro Clima tapes used to seal junctions.

To achieve passive house certification, each house had to individually meet the airtightness requirement of 0.6 air changes per hour, and test results ended up between 0.35 and 0.6 air changes per hour.

A wood chip district heating system, fuelled by chips from a local woodland, services the whole community. The 150kW Herz boiler was installed in an old Halton Mill building, which provides a workspace for residents.

The roof of the mill is undergoing insulation and airtightness work. The budget to renovate the mill was limited, so it was decided to undertake a deep retrofit on the roof, where 30% of heat is lost, rather than a modest upgrade of the whole building.

But the mill has a high heat load compared to all the dwellings combined, so the real decision came down to how the mill was heated.

"We didn't really want to use fossil fuels," Andrew Yeats says. "It was kind of an obvious choice really."

The mill has a 40kW solar thermal array too, and the district heating system is setup to take heat from this as a priority before the boiler kicks in.

A network of pre-insulated pipework distributes hot water to each of the dwellings, which have just one or two Quinn radiators each. A lot of heat can be lost over a district heating network, but by performing a detailed analysis to work out the hot water demand first the team was able to specify smaller pipes, which will help to avoid unnecessary losses.

Most of the dwellings are ventilated by Paul Focus 200 mechanical ventilation systems with heat recovery (MVHR), with the exception of the six one-bed flats, which use Zehnder ComfoAir 200 MVHR systems instead. "This was due to the need to achieve a base airflow rate suitable for single person occupancy which was lower than the minimum flow rate of the Focus," explains M&E consultant Alan Clarke. "It also helped with space constraints as the MVHR had to go in the kitchen and the Zehnder unit fitted inside a single 600mm kitchen unit."

For electricity generation, substantial solar photovoltaic arrays – selected for their green and ethical credentials as well as their efficiency – sit on south-facing roofs, and Forgebank is also planning to hook up to the nearby 160kW Halton Lune hydropower scheme. This was essential for reaching Level 6 of the Code for Sustainable Homes — the highest rating possible — which the development achieved. Electricity use at the development is unusually low though, most likely because there are so many shared facilities.

A decision was taken not to install rainwater harvesting systems, with water conservation measures adopted instead, including rainwater butts, plus low-water taps, showers, baths and WCs and water efficient white goods.

But apart from energy efficiency and environmental stewardship, community is at the core of Forgebank.

A sedum-roofed common house — built to the same spec as the homes, but not passive house certified — provides communal facilities for cooking, eating, and socialising.

There's also a pedestrian-only street running through the community, plus a bike store, a new pathway along the river, and a small woodland too. The residents have also come together to form a food co-op to buy food in bulk. All community decisions are made by consensus.

Nonetheless certain lessons have been learned: for one, Andrew Yeats thinks there should be a minimum of two airtightness champions on big projects, and that more attention must be paid to communicating the importance of airtightness down to every tradesmen on site, to ensure sealing work isn't rushed, or done during damp periods, just to expedite the build schedule.

A Building Use Studies survey revealed a few concerns among residents that need to be addressed, but overall the responses were excellent, and interviewees cited the warmth and comfort of the homes, the views over the river, and being closer to neighbours as the best aspects of living at Forgebank.

Fairly extensive monitoring has been carried out since construction too.

A coheating test on one dwelling revealed a measured heat loss of 47.1 W/K, compared to the 39.6 W/K predicted in Sap. Relative humidity was initially high after construction, but levelled off at a normal value of around 40%. Winter temperatures inside are a steady 19-20C.

"They're not overheating in summer, and they're nice and warm in winter," Jon Sear says.

And for the residents comfort, ultimately, is the most important thing.

"The houses aren't overheating in summer, and they're nice and warm in winter"

Tom Lelyveld, who works in energy consulting, only heard about the project in 2011, but found the idea exciting and ended up buying a home here. He and his partner were looking for a good place to raise their young son, and the idea of a pedestrian-only street for kids to play on particularly appealed.

"It was the community aspect, but also I had been on a study trip to study passive house in Germany, and I like it as a concept," he says. "It has pretty much exceeded my expectations in terms of comfort."

He says that he just has to set his thermostat to maintain a constant temperature and leave it at that.

"They never get super hot, it's more just about topping up." On sunny days in winter, the temperature inside can reach 22C purely on solar gains.

"It's a lovely place," Tom says of the community. "When we had this massive great heat wave, you walk up the river about ten minutes and you've got a great swimming spot."

The first residents moved in last August, and the last of the homes were in the process of being handed over at the time of writing. All units have been sold.

SELECTED PROJECT DETAILS
Client: Lancaster Cohousing
Architect: Eco Arc
Contractor: D Whittle Construction
Passive house consultancy & building services engineers: Alan Clarke & Nick Grant
Quantity Surveyor & Project Manager: Turner & Holman
Project finance/mortgages: Triodos/Ecology Building Society
Passive house certification: Warm
Civil & structural engineering: Gifford (since acquired by Ramboll)
Landscape design: Camlin Lonsdale Landscape Architects
Code for Sustainable Homes assessor: Eric Parks
Airtightness: Paul Jennings
Mechanical contractor: Rogerson Homeserve +
Electrical contractor: R Thomson Electrical Contractors
Groundworks contractor: William Pye
Roofing contractor: Pears Roofing

Insulation contractor: A&M Energy Solutions
Sedum roof contractor: Green Roofs Naturally
District heating design: Pettit Singleton
District heating contractor: James Mercer
Solar thermal installers: Campbell Stewart
Masonry (Enviroblock): Aggregate Industries
Kerto timber frame panels: Metsawood
Wood fibre insulations: NBT & Ecological Building Systems
Wall ties: Ancon
Thermal blocks: H&H Celcon
Airtightness products: Ecological Building Systems
Damp proof membrane & radon barriers: Visqueen
Glass wool insulation: Knauf
Below DPC cavity insulation: Springvale EPS Ltd
Ground floor insulation: Jablite
Windows: Green Steps
Roof lights: Fakro
Roof tiles: Sandtoft
Cement fibreboard: Marley Eternit
GGBS: Tarmac Topmix
Paving: Hanson Formpave
Painting & decoration: SML
MVHR systems & low water fittings: The Green Building Store
MVHR systems for 1 bed flats: Zehnder
MVHR ductwork, grilles & terminals: Lindab
PV supplier: The Better Roofing Company
Wood chip boiler & fuel feed system: Barden Energy
District heating pipework: Rehau
Hot water cylinders: Mcdonald Engineers
Solar thermal array: AO Smith
Solar cylinder: Akvaterm
Heat metres: Kamstrup
Regulating valves: Danfoss
Radiators: Quinn Radiators UK
Kitchens: Howdens Joinery
Low water fittings: Hansgrohe
Utility services: Quartzelec

[1]A free technical briefing on Denby Dale is available at http://bit.ly/SwNimJ

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PROJECT OVERVIEW:

Development type: 41 certified passive dwellings across seven terraces, ranging from two to ten units per terrace, and associated common house.

Location: Halton, Lancaster

Completion date: 2012

Budget: £5.7m inclusive of 41 dwellings, community buildings and site works. £1,825 per square metre inclusive of extensive demolition, remediation and site stabilisation works. £1,505 per square metre exclusive of these costs.

Passive house certification: All 41 residential units certified. Common house not certified.

Space heating demand (PHPP): 12kWh/m²/yr (average over all dwellings)
Space heating demand (measured): 13kWh/m²/yr (average over all dwellings)

Heating load (PHPP): 9W/m² (average over all dwellings, no cooling)

Primary energy demand (PHPP): 81kWh/m²/yr (average over all dwellings)
Primary energy demand (measured): 77 kWh/m²/yr (average over all dwellings)

Code for Sustainable Homes: Level 6

Airtightness (at 50 Pascals): ranging from 0.35 to 0.6 ACH

Energy performance certificates (EPC): pending

Thermal bridging: Ancon TeploTie low thermal conductivity wall ties, H+H Celcon aerated thermal blocks in all perimeter and party walls at sub floor and above ceiling levels (from eaves to roof apex) & to form inner leaf (with 1200mm width x 200mm thick Kingspan Kooltherm insulation at steel windpost) in end of terrace walls.

Ground floor: traditional strip foundations. Timber flooring finish, on 150mm RC30 GGBS Concrete slab, 500 gauge Visqueen EcoMembrane recycled slip sheet, 250mm Jablite 70 floor grade under-slab EPS insulation, 1200 gauge Visqueen EcoMembrane DPM (in terraces D & E) or Visqueen radon membrane (terraces A, B, C and F) or a separate radon membrane in terrace G, on sand binding & hardcore. U-value: 0.14

Intermediate floors: 22mm thick T&G floorboards, 253mm deep steel web floor joists containing 100mm MVHR ductwork & drainage ductwork; 200mm sound insulation; plasterboard ceiling finish.

Cavity walls: 8-10mm Wetherby external render system, 100mm Masterblock Enviroblock EV11 100% recycled aggregate concrete block forming both the inner and outer leaf, with three to six courses of blue engineering brick used below DPC at outer leaf. 300mm cavity in-between with Type 2 TeploTie reinforced basalt fibre wall ties and 300mm full-fill Knauf Dritherm recycled glass wool insulation. U-value: 0.12. 300mm Springvale Platinum Floorshield insulation below DPC at perimeter to act as formwork when casting slab.

Timber frame infill sections: 9mm Marley Eternit Operal board, on battens, on ProClima Solitex breather membrane, on 100mm NBT Pavatherm wood fibre insulation board with joints sealed with NBT Pavatape, on 9mm OSB fixed to 300mm Kerto structural sub frames filled with Knauf Dritherm 37 insulation, on 9mm OSB and Pro Clima Intello vapour control layer, on battens for service cavity, finished inside with 12.5mm plasterboard. U-value: 0.12

Trussed roofs: Sandtoft Cassius clay tiles on battens and counter-battens, Pro Clima Solitex Plus Breather membrane, bob tail truss, 500mm of Knauf Loft Roll recycled glass wool insulation, 18mm OSB taped with Tescon No 1, 25 x 50 battens, 12.5mm plasterboard. U-value 0.1

Cathedral roofs: Sandtoft Cassius clay tiles on battens and counter-battens, Pro Clima Solitex Plus Breather membrane, 22mm Gutex Multiplex Top woodfibre board, 350mm rafters with Knauf Perimeter Plus loose blown glass wool insulation, on 9mm OSB, on Pro Clima Intello vapour control layer, on 25 x 50 battens, on 12.5mm plasterboard. U-value: 0.1

Common house sedum roof: Green Roofs Naturally's sedum roof system – comprising sedum sprout mix, extensive soil substrate, Nutrifoam mat and water/roof proof membrane – on 18mm thick WBP ply deck, 50mm treated SW battens, Pro Clima Solitex Plus breather membrane, 18mm thick OSB sarking board, 400mm deep JJI roof rafters insulated with Knauf Perimeter Plus, 12mm OSB, Pro Clima Intello VCL, 50x25mm battens to form services void, 12.5mm thick plasterboard & skim. U-value: 0.1

Windows: Green Steps alu-clad triple-glazed windows with low e coatings, argon fill and insulated Thermix spacers. Overall U-value: 0.9

Roof lights: triple-glazed Fakro FTT-U5 Thermo roof lights installed in three one-bed flats. Centre pane U-value: 0.5

Heating: up to 93% efficient 150kW Herz wood chip boiler – with modulation from 37 to 151 kW – and 40kW of solar thermal energy – comprising two x 14 panel AO Smith flat plate arrays with drainback function, with a Resol Deltasol BS/4 controller and Akvaterm solar accumulator tank - distributing heat via a district heating network of pre-insulated Rehau pipework.

Microgeneration: 4 solar photovoltaic arrays giving a total of 48 kWp. REC 245w panels on Schletter mounting system with SMA Tripower inverters.

Ventilation: separate Paul Focus 200 MVHR systems in all 35 houses. Passive House Institute certified heat recovery rate of 91%. Separate Zehnder ComfoAir 200 MVHR systems in all 6 flats, with Passive House Institute certified heat recovery rate of 92%.

Paving: Hanson Formpave Ecogranite paving range used throughout, featuring 77% recycle materials – including Combined Royal Deeside Victoria at terraces A-F and Aquasett Pennant permeable paving at Terrace G.

Water conservation: ES4 four litre siphon WCs with leak free flushing technology.

Green materials: Masonry block made from recycled concrete aggregates, GGBS cement, wood fibre insulations products, recycled glass wool insulation.

PIONEERING PASSIVE OFFICE

surpasses expectations

When it comes to actual energy usage, modern buildings rarely perform as expected, with many notionally low energy buildings falling disappointingly short. As discussion continues about how to solve the performance gap, one pioneering Welsh passive building has a different kind of performance gap – it's using 40% less energy than anticipated.

Words: Lenny Antonelli

When it was built in 2009, Canolfan Hyddgen in Machynlleth became the first certified non-domestic passive house in the UK. Four years on it's still picking up accolades, winning a UK Passivhaus Award this year.

The building's sustainability agenda goes way beyond energy efficiency to encompass materials, water, biodiversity and more. It has a BREEAM excellent rating, the highest available at the time.

Built for Powys County Council, the centre houses IT for a neighbouring school, facilities for adult learners, meeting rooms and a drop-in centre and council service point.

Leading passive house architect John Williamson, also based in Machynlleth, designed the building, while local firm C Sneade acted as contractor. Williamson was also responsible for the UK's first certified residential passive house, Y Foel, also in Wales.

Tried & tested

So how has the building performed since it was constructed?

"We feel the heat loss is fairly close to what we

Photos: JPW

predicted," Williamson says. In fact measured space heating demand (14.8kWh/m²/yr) is almost exactly what was projected (15kWh/m²/yr).

Winter temperatures inside vary between a comfortable 20 and 22C, depending on how the thermostatic radiator valves (TRVs) are set.

Perhaps surprisingly, the building's primary energy demand (80kWh/m²/yr) is almost half that projected (144 kWh/m²/yr), mainly because computer use has been lower than expected.

Those familiar with the passive house standard know that even the latter figure is above the 120kWh/m²/yr demanded for certification. But because Canolfan Hyddgen houses electricity-hungry servers for other buildings, and because the team did everything possible to cut power use, the Passive House Institute still certified it.

The energy used to heat the building has dropped 40% since it was built, as occupants get to grips with how it functions — and learn, for example, that in a passive building radiators needn't be on if a room with lots of computers is full with people.

Now the boiler is only used briefly on cold mornings. And close monitoring has enabled the team to adjust timer controls and settings to cut energy use even further. Monitoring of a classroom full with 22 adults showed carbon dioxide, humidity and indoor temperature all within normal levels.

Simple heating design

A small gas boiler provides space heating at Canolfan Hyddgen. "We didn't want to complicate the project with extravagant renewable systems," Williamson says. The boiler was the smallest the team could find, but at 9-22kW he reckons it's still too big.

"I've never seen so little plant in a building of this size," says building manager Edward Cain. If it's needed, the boiler delivers heat to low surface temperature radiators in the main teaching rooms and a few of the public spaces.

Heating controls are designed to be simple, robust and easily adaptable. "Boiling something complicated down into something simple is the challenge," Williamson says.

Radiators at Canolfan Hyddgen are equipped with TRVs to give occupants control. But the boiler also kicks in automatically if the indoor temperature drops below a set level.

The only hot water demand is from sinks, so point-of-use electrical heaters were chosen for water heating. But with minimal pipe runs, low flow spray taps and timer switches, water use is designed to be low.

"If you minimise the amount of water you need in the first place, then you don't need all this complicated kit behind it to provide the water," Williamson says.

Lighting, cooling and ventilation

Office and meeting rooms sit around the perimeter of the building to benefit from sunlight, with IT teaching spaces at the core. But a corridor and breakout spaces separate these areas from the glazed facade to protect occupants from glare and overheating. Brise soleils on the south facade, coupled with the asymmetrical pitched design of the roof, helps control these issues too.

Meanwhile, the building's masonry core provides thermal mass that helps to smooth internal temperatures by absorbing heat and releasing it slowly.

The ground floor slab contains 60% Hanson Regen GGBS (ground granulated blastfurnace slag), a low carbon alternative to portland cement that's made from a by-product of iron manufacturing.

Meanwhile the internal walls are constructed from Enviroblock, which is produced from secondary and recycled concrete aggregates. Made in the UK by Aggregate Industries, the blocks are suitable for use above or below the damp proof course, internally or externally. Enviroblock has been awarded the BRE's 'Responsible Sourcing' certificate, which is given to products that demonstrate environmental and social responsibility.

On summer nights, the building's ventilation system purges heat from the masonry elements to cool the building for the next morning.

The building is naturally ventilated during the day in summer, with the MVHR set to summer bypass mode to maintain extract requirements from toilets, and cooling the building at night if needed. “The natural ventilation strategy in summer has worked well to reduce operational energy use,” says Williamson, “particularly now the occupants are confident in its use.”

Williamson considered ventilating the building naturally with automated windows, but says this would have been ineffective on windless days, and expensive. So instead the building is ventilated by five Drexel & Weiss heat recovery ventilation units - comprising three decentralised and two centralised units. “They’re not certified yet, but they’ve been used successfully in many certified passive house schools and offices,” says Williamson.

Timber frame envelope

While the core of the building is masonry, the thermal envelope is constructed from timber frame that sits on a thermal block -built plinth, together with an I-beam cassette roof. The timber frame elements are insulated with Warmcel cellulose, which is made from recycled newspaper made in Wales, installed by Powys-based firm Pen Y Coed.

Williamson says he particularly likes Warmcel for its hygroscopic buffering and excellent decrement delay attributes. ▶

(above) The building features a pitched roof with a solar PV array on the south-facing slope and a sedum roof, sown with local wildflowers, on the north slope; (below) 300mm of Jablite insulates the groundfloor; (inset) airtightness and insulation around the MVHR ductwork; (p45) the building is clad in locally sourced European larch (top); its structure combines timber frame external walls and Enviroblock internal walls on a GGBS slab.

The south-facing roof slope features a 7kW photovoltaic array, supplied by Dulas, that produces 25% of the building's electricity. The north slope features a biodiverse roof sown with local wildflowers, designed in conjunction with local wildlife groups.

Williamson says the sedum roof offers excellent decrement delay too. "It really helps with keeping the building cool," he says.

The dilapidated 1850s building that previously occupied the site was demolished, but its roof slates & cills were incorporated into Canolfan Hyddgen's roof, while the old building's walls were crushed and used in the construction of new drainage systems and hard landscaping.

Canolfan Hyddgen also smashed the passive house airtightness standard of 0.6 air changes per hour with a score of 0.25. The thermal envelope was made airtight using Pro Clima Intello Plus 'intelligent' vapour checks in conjunction with Pro Clima tapes and glues, all supplied by Irish company Ecological Building Systems.

But despite the runaway success of the project — it was the first building in the world to achieve passive house and BREEAM certification simultaneously — Williamson says some lessons were learned. ▶

For one, establishing a building's IT strategy at the outset is crucial. Late in the design phase Powys County Council appended a server room to the plans, which added 720 watts of heat. This demanded some late design tweaks to prevent overheating, such as adding a second brise soleil above the ground floor on the south façade and redesigning summer extraction ducts to the server room.

Williamson says another important lesson is that local authorities are often locked into framework agreements with technology suppliers, meaning they can't always switch to new energy efficiency technology or supply chains easily.

The cost of the build ended up at £1,537 per square metre — not including the PV, biodiverse roof and canopy — and £1,784 when these are included.

But the proof of the building's success is comfort: Williamson says that during recent cold winters, staff at Canolfan Hyddgen "couldn't wait to get into work".

Though the building is four years old it only entered the UK Passivhaus Awards this year, as real-world monitoring data is required for entry. And it emerged victorious in the non-domestic category, beating strong competition from both the Green Base community centre on Merseyside and the new offices of construction firm Interserve, two other flagship passive house projects. The project had previously won a Welsh Local Government Association sustainability award, and a CIBSE new build of the year prize.

Speaking at this year's Passivhaus Awards, Williamson praised the Passivhaus Trust for creating awards that recognised both energy efficiency and aesthetics.

He said: "We hope such successful examples of passive house will inspire others to adopt and engage with this proven approach to low energy buildings."

SELECTED PROJECT DETAILS
Client: Powys County Council
Architect & consultants: JPW Construction
Contractor: C Sneade
Passive house certifier: Passive House Institute
Civil & structural engineering: Bob Johnson Consulting Structural Engineers
Electrical contractor: EOM Electrical contractors
Airtightness testing & consultancy: Airtight Noisecheck
Cellulose insulation: Warmcel, installed by Pen Y Coed
Floor insulation: Jablite
Sheathing board: Hunton
Cladding: Powys Castle Estates
Plasterboard & plaster: British Gypsum
Masonry: Enviroblock (Aggregate Industries)
Airtightness products: Ecological Building Systems
Windows and doors: Internorm
Screeds & GGBS: Hanson
Ventilation: Drexel & Weiss
Low water fittings: Green Building Store
Green roof: ICB
Solar PV: Dulas
Solar PV inverter: Fronius
Condending boiler: Remeha

PROJECT OVERVIEW:

Building type: Local authority offices and learning centre

Location: Machynlleth, Powys, Wales

Completion date: November 2008

Budget: £1.2 million. Funded by Welsh Assembly and Powys County Council.

Space heating demand (PHPP): 15 kWh/m²/yr

Space heating demand (measured, average over 4 years): 9 kWh/m²/yr

Heat load (PHPP): 4.8kW

Primary energy demand (PHPP): 144 kWh/m²/yr

Primary energy demand (measured, average over 4 years): 50 kWh/m²/yr

Carbon emissions (PHPP): 84. kg CO_2 m²/yr

Carbon emissions (measured): 48.4 kg CO_2 m²/yr

BREAM Offices: Excellent (84.43%)

Airtightness (at 50 Pascals): 0.249 ACH

Ground floor: Slate finish with 150mm Regen GGBS slab under this, followed underneath by 300mm Jablite 70 EPS insulation. U-value: 0.122

Walls: European larch cladding counterbattened to 22mm Bitroc sheathing board externally, followed inside by 195mm stud insulated with Warmcel, 9mm OSB, 50mm service cavity, 25m Gypsum plasterboard, Gypsum Plaster skim finish. U-value: 0.18

South roof: build up features 300mm of Warmcel with 50mm uninsulated service cavity inside this, and finished internally with 13mm Gypsum plasterboard and Gypsum Plaster skim finish. U-value: 0.125

Windows: thermally broken triple-glazed Internorm Edition windows with Krypton filling. U-value: 0.78

Heating system: Heating system: 24-9kW Broag Remeha low NOX condensing gas boiler, providing 4054 kWh/yr (PHPP)

Ventilation: five Drexel & Weiss Aerosilent Business units, with 85% heat recovery according to VDI 2071

Electricity: 7kW solar photovoltaic array with Fronius inverter. Producing 19.38 kWh/m²/yr. Projected to produce 5250kWh/yr but monitoring found it producing 6493 kWh/yr in 1st year due to cold bright sunny winter weather. Average dropped back over four years when two milder overcast winters and a very wet summer were included.

Green materials: recycled concrete blocks, cellulose insulation, timber frame elements, GGBS

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Vernacular passive

A building doesn't have to be designed as a cube to meet the passive house standard, but it helps. This as yet uncertified passive house in Carlow shows that, climate permitting, less compact designs can be made passive – by pushing the envelope.

Words: Lenny Antonelli

Architectural photos: Tomasz Juszczak / Construction photos: OLS Architects

Most passive buildings are compact, south-facing and simply-shaped. Starting from these first principles maximises solar energy gains and reduces heat loss — a big leg up for any project trying to meet the passive house standard.

But this house in County Carlow threw the rulebook in the bin, and instead adopted the aesthetic of a traditional Irish farmstead: a cluster of buildings around a central farmyard — not necessarily the ideal layout for saving energy.

But it proves that achieving the passive house standard needn't mean building a boring box, particularly in the mild climate of south-east Ireland.

Passive House Plus's predecessor magazine, Construct Ireland, first published a short profile of the project in 2011, when construction was nearing completion.

Since the house was finished, it has become one of Ireland's flagship passive house projects — not just for its energy efficiency, but also its thoughtful vernacular design. It was one of the finalists at this year's Isover Ireland Energy Efficiency Awards, and won in the residential section of the Saint-Gobain awards last year.

But homeowner Tony Holden says he didn't build a passive house for environmental reasons — that was just an added bonus.

"The main reason I'm building a passive house is that it's a quality control stick. It's a standard I can test. I've got good metrics to ensure my house is as it's supposed to be," he told us back in 2011. He's been living in the house about 18 months now — so how was it performing?

"I'm very happy with the house," he says. "I'm very relaxed in the house and delighted [the build] is all over."

There was some overheating this summer, but he acknowledges temperatures rose unusually high this year.

Plus, he was keen to have a generous amount of glazing on the south and west facades, and knew overheating could become an issue from the design stage.

"I wouldn't say it's uncomfortable, we've kind of got used to it at this stage," he says.

One particular overheating issue occurs on the west-facing wing in summer.

"While we did put a brise soleil to the west it is never very effective, as the sun is setting and is therefore very low on the horizon," says project architect Cathal O'Leary of OLS. He says internal blinds will probably be necessary to help control any overheating here.

But Cathal says he's not generally a fan of using internal blinds to control overheating — it often means closing off views on the sunniest days of the year. Generally, he thinks getting the balance of glazing right, and designing in external shading is the answer.

Tony's now investigating whether it's feasible to re-engineer his 8kW Danfoss ground source heat pump, which draws heat from a 110m borehole, to provide cooling in summer.

Heating in the house is distributed by wall-based Variotherm panels — essentially pipes encased in Fermacell board — and Tony wants to work out whether circulating water through the panels at 10-15C can provide adequate cooling."I can't go too cold or I'll have condensation on all the walls," he says.

He had originally planned to install a wood pellet stove, solar thermal system, plus heating elements in the heat recovery ventilation. But he says that plan grew too elaborate and expensive, so he scrapped it and put in one ground source heat pump for space and water heating. Damien Mullins of Heat Doc, who designed the system, says in practice at Tony's house the heat pump has a COP of about six for space heating, and seasonal performance factor of around 460.

"If you were to run it in any low energy building like the Holdens' house, then your seasonal performance factor will be higher because your input temperature from your bore holes is high and your output temperature is low. The SPF for space heating in this case might be 6 or 7," Damien says.

Heat pumps work most efficiently when they're gradually feeding low temperature heat into a thermal store – typically the floor itself, via underfloor heating pipes. But the Variotherm wall panels aren't intended to provide a thermal store – instead they offer quick response, even with low temperature heat. Heat Doc's solution was to install a 400 litre buffer tank so that in addition to the hot water cylinder, the heat pump can operate consistently at optimal efficiency, ▶

topping up a reservoir of hot water so that it's there when needed.

The house has a room-sealed, airtight solid fuel stove too.

"We had to exceed the passive standard because we didn't build a compact form house. The airtightness had to be a lot better than the minimum requirement."

Hitting the passive house standard was important, but it wasn't Tony's first priority – design came first.

The finished house breathes new life into the word 'vernacular', a term often used to describe dull, uninspired bungalows. But this genuinely recalls an old Irish farmhouse, with its white walls, slate roof and clustered, almost organic layout.

"The thing that I really liked about Tony and Siobhán is that when we met them, they said they wanted a house that fitted in the landscape," says architect Cathal O'Leary. "We designed it first and then tried to make it passive after, if we could within the budget."

The house is divided into three 'blocks', centered on a courtyard. The bedroom wing lies to the east to catch the morning sun, the kitchen and living areas face south, while a more formal entertaining room occupies the west wing. The yard is then enclosed by a separate workshop/garage to the north.

Of course this kind of design doesn't usually lend itself to energy efficiency, though architect Cathal O'Leary says the volume to surface area ratio in this case is surprisingly good at 0.79.

But to be sure of hitting the passive house standard, the team had to compensate by designing an ever more efficient thermal envelope.

"We had to exceed the passive standard because we didn't build a compact form house," Tony says. "The airtightness had to be a lot better than the minimum requirement."

This meant a daunting target of 0.3 air changes per hour (which was achieved), rather than the usual 0.6, and the building's walls, roofs and floors are heavily insulated even by passive house standards, with all U-values below 0.1.

Even then, considering the layout, Cathal O'Leary says the same house built in central Europe wouldn't hit the passive house standard.

Before the build Tony went out to tender for cavity wall, single leaf block and timber frame construction, but cavity wall came in cheapest.

The build-up features 100mm Cemex block externally, 150mm Quinn-Lite Aircrete block internally, and a 300mm cavity in between that's filled with Korefill bonded beat insulation. Inside the inner leaf, there's a further 75mm insulated service cavity.

(opposite) The masonry building's cavity walls feature TeploTie basalt wall ties and an inner leaf of Quinn Lite low thermal conductivity blocks; (This page, above) Light shining into the dining area in the west-facing wing of the house. This can be a cause of overheating in the summer as the setting sun is too low in the horizon for the brise soleil to be very effective; airtightness measures include the Isover Vario vapour barrier (below left) and Gypsum Airtite Quiet parge coat (middle); while the Optima system's thermally broken steel structure addresses thermal bridging.

For airtightness, there's a Gypsum Airtite Quiet parge coat on the inner block leaf, plus a vapour membrane in the service cavity build-up.

Cathal O'Leary says the extra-thick build-up adds to the vernacular feel of the house, evoking the bulky walls and deep reveals of old Irish houses built from random rubble or mud.

Upstairs, the roof is insulated with Climowool KF2 glass fibre, while airtightness here is provided by an Isover Vario vapour barrier.

The ground floor features a Viking House Passive Slab foundation system, which includes 400mm of EPS Kore insulation. The windows are Pazen Premium Maximum triple-glazed Eucalyptus units with aluminium cladding externally.

While Tony and his wife Siobhán have been living in the house for nearly 18 months, landscaping work has just begun, and Tony says that because of this, the house doesn't recede into the landscape as much as he'd like just yet. ▶

The neatly configured plant room (above) includes a Paul Novus 300 MVHR system and 8kW Danfoss PHP Opti Pro heat pump; (below) window reveals insulated with phenolic insulation to reduce cold bridging; a plywood box used for ease and accuracy of window positioning; Gyproc plasterboard and the Vario airtight system.

"The colours are quite stark at the moment until we get the landscaping done," he says. He also plans to do some planting on the wall of the garage, and the gable ends of the house, to help blend it in further.

OLS have yet to submit the house for passive house certification, but plan to later this year.

Tony reckons that because the less-than-optimum layout required the house to go the extra mile in terms of thermal performance, it wasn't the most economical build.

He's not sure if the extra cost of reaching the passive house standard, considering the design, was justified.

"I'm very happy with the house and a lot of the cost is probably associated with the design rather than the fact that it's passive," he says.

But he says hitting the passive house standard verifies the house is well built.

"It's a real measure of the quality of a build."

SELECTED PROJECT DETAILS
Client: Tony & Siobhán Holden
Architect: OLS Architects
Civil / structural engineer: Peter Bolger Consulting
Main contractor:
American Timber Framed Houses Ltd (liquidated)
Mechanical contractor: Heat Doc
Airtightness tester: Integrated Energy
Indicative BER: 2eva.ie
Airtightness, roof insulation & internal insulation system: Isover
Plasterboards & plaster: Gyproc
Wall & floor insulation: Kore Insulation
Roof insulation: The Insulation Store
External render: Weber
Thermal blocks: Quinn Lite
Dense concrete blocks: Cemex
Thermally broken cavity wall ties: Ancon
Insulation for window reveals: Kingspan
Windows and doors: Pazen Ireland
Radon barrier: Tradecraft
OSB: Smartply
Roof trusses: DTE
Zinc roof: VMZINC
Roof tiles: Capco
Heat pump: Heat Pumps Ireland
MVHR: Pure Renewable Energy
Bore hole: Wall's Well Drilling
Flooring: AML Architectural Products
Lighting: Willie Duggan Lighting

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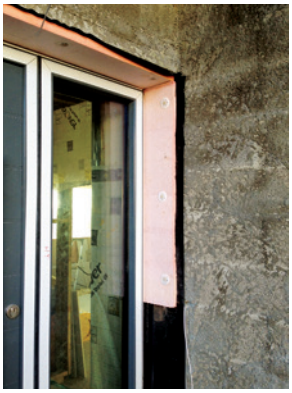


PROJECT OVERVIEW:

Building type: 295 sq m detached stepped single-storey house, with a wine cellar attached and a workshop detached.

Location: Tullow, Co Carlow

Completion date: September 2011

Passive house certification: pre-submission

Space heating demand (PHPP): 15 kWh/m²/yr

Heat load (PHPP): 10 W/m²

Airtightness: 0.3 ACH

Indicative BER: A2 (46.26 kWh/m²/yr)

Ground floor: Viking insulated concrete raft foundation, insulated with 400mm of EPS Kore insulation with Rhinoplast Ultra Radon barrier. U-value: 0.8

Walls: 15mm Weber render to 100mm Cemex dense block external leaf, 300mm cavity filled with Korefill bonded bead insulation with Ancon basalt Teplotie wall ties, 150mm Quinn-Lite Aircrete block to inner leaf, with Gypsum Airtite Quiet parge coat, and Isover Optima internal insulation system to provide 75mm insulated service cavity including Isover Metac insulation, thermally broken steel structure, Vario vapour barrier/airtight system, 12.5mm Gyproc plasterboard with skim finish. U-value: 0.09

Pitched roofs: Capco fibre cement slates externally on treated timber battens/counter battens, followed underneath by breathable roofing underlay, to DTE timber roof truss, with 500mm Climowool KF2 glass fibre insulation between joists, Vario vapour barrier, 18mm taped & sealed Smartply OSB, 150mm uninsulated service cavity, 12.5mm Gyproc plasterboard ceiling with skim finish. U-value: 0.08

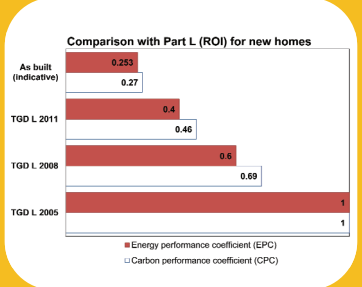
Flat roofs: VMZinc Plus Quartz zinc standing seam externally, followed underneath by breathable roofing underlay, on WBP plywood support, on treated timber fillet battens to create fall and ventilation, on 250mm treated timber joists/counter joists in-filled with Climowool KF2 glass fibre followed underneath by Vario vapour barrier, 18mm taped & sealed Smartply OSB, 150mm uninsulated service cavity, 12.5mm Gyproc plasterboard ceiling. U-value: 0.08

Windows: Pazen Premium Maxi triple-glazed aluminium-clad eucalyptus hardwood windows, with argon filling and an overall U-value of 0.77. Kingspan phenolic insulation used to prevent cold bridging at window reveals.

Heating: an 8kW Danfoss DHP Opti Pro ground source heat pump with a closed loop collector in a 110 metre vertical bore hole. The tested COP is 4.34/4.88 under different test conditions, but more likely circa 6.0 here due to the low Delta T required in such an efficient house. The heat pump feeds a three hundred litre hot water cylinder.

Ventilation: Paul Novus 300 heat recovery ventilation system — Passive House Institute certified to have heat recovery rate of 93%, and an electrical efficiency of 0.24

Green materials: Pazen Eucalyptus hardwood windows, Isover recycled glass mineral wool roof insulation, reclaimed oak timber plank flooring, Tretford eco backed carpet, all roof timbers from PEFC certified sources.



Media HQ

shows ultra low energy vision

While Ireland's minimum energy performance regulations for dwellings have come on leaps and bounds in recent years, standards for non-domestic buildings have remained untouched. Which makes forward-thinking media production company TVM's new ultra low energy HQ all the more impressive.

Words: John Hearne & Jeff Colley

The winner of the Green Building Award at the 2013 Green Awards, the new Television Mobiles Ltd (TVM) HQ in Bartlemy Co Cork is a highly ambitious project. It succeeds in bringing low energy design principles to bear on a workspace that serves a diverse range of functions.

The building provides 1,250 sq m of interconnected offices, meeting rooms, an editing studio, canteen and engineering workshop for the television broadcast and production specialists, TVM. The company, which was established by Bart and Helen Arnold in 1986, provides outside broadcasting facilities to a range of media organisations.

Bart Arnold explains that the company had outgrown its old premises across the road from the new site long before the first sod was turned on the project. Four distinct but interconnected spaces were required. The open plan offices are housed in a cottage and in a new two-storey building connected to the cottage via the architectural centrepiece of the project – a 2.5 storey cylindrical drum finished in American cedar. To the rear of this space, a large industrial warehouse was designed to accommodate the articulated vehicles and related workshops that deliver the company's outside broadcast services.

"When it came time to build," Bart says, "we said, ok, we're probably only going to do this once ever in our lives so let's try and build something first of all that is not an industrial building, something that has architectural value and, as part of our drive to try and be as ecologically friendly as possible in what we do, we decided to explore the options and see if we could build an industrial office building to passive house standards."

While the project isn't a certified passive house, it does show some of the characteristics of a passive house. Impressive U-values for the opaque elements all sit within the sort of range that's typical of certified passive buildings – in this case between 0.104 and 0.15 – and a mid-construction blower door test result of 0.52 ACH indicates that the building may be there or thereabouts in terms of airtightness.

The building features triple-glazed doors and windows. Described by manufacturer Viking Window AS as "windows for passive houses", the windows – which offer centre pane U-values of 0.6 – are not included in the Passive House Institute's certified component database.

Michael Regan of E-Project Chartered Architects says that one of the central challenges of the project was to create a headquarters that would meet all the functional requirements of a highly

sophisticated business, while also sitting comfortably into a rural village environment. The finished buildings would face the school and church directly across the road.

“The client was quite keen that the design wouldn’t be shouting at the rest of the village,” says Michael. “For that reason the incorporation of the cottage element as part of the scheme maintained the established village scale of the development along the road frontage. Then as you progress back through the site, the building becomes much more innovative in terms of its design, and then purely functional for the workshop at the back.”

If marrying these conflicting imperatives wasn’t challenging enough, the client’s insistence on high standards of sustainability raised the bar even higher.

Planning permission had been granted by the time Michael Regan joined the E-Project practice. However, much of the detail within the planning approved scheme changed substantially as the architects and the full design team worked through the details and more research and technical calculations were established during the detail design stage.

“For planning purposes, there were a lot of green agenda items included, but a lot of these fell by the wayside, not for cost reasons, but because they were found to be impractical,” Michael says. “For example, at planning stage, the workshop building had a south facing solar wall. We found however that so much hot water would be generated that it couldn’t be used. You’d just be dumping it.” A smaller solar array has been included to suit the actual hot water requirements of the building in use.

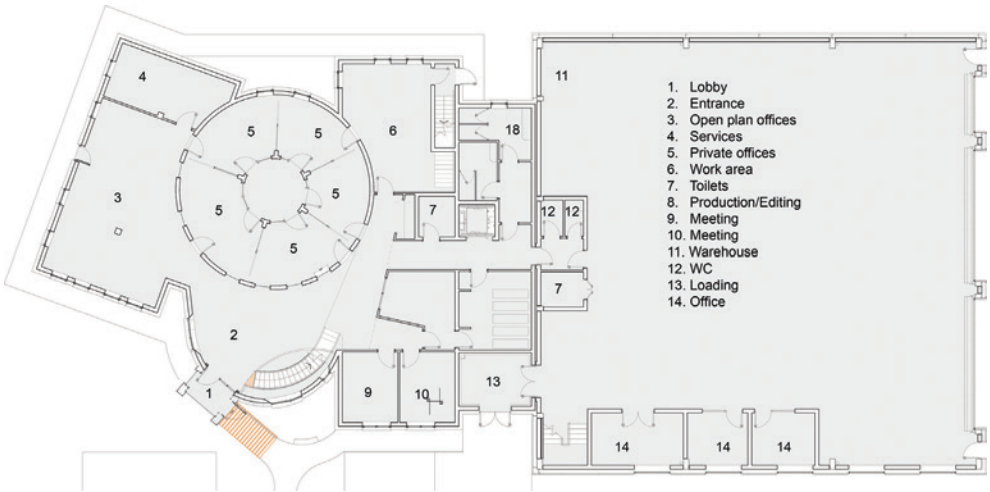
In addition, the south facing roof of the workshop was fitted with 217 sq m array of 130 photovoltaic panels from PV Tech – the largest of its kind in Ireland. The system comprises a 32.5kW array of German-manufactured Hanwha Q-Cells Q.Pro polycrystalline panels, along with three 3-phase 10kW Steca grid tie inverters. If the array produces unusable electricity, that power can be sold onto the grid.

PV Tech’s Mike O'Rourke says that the PV array will produce around 28,000 kWh of electricity per year – equivalent to approximately 68,000 kWh of primary energy usage and 15,000kg’s of carbon emissions reductions, as well as an annual energy saving of between €4,000 and €5,000. It’s estimated that the huge PV array will pay for itself within ten years.

Post planning design development also saw half of the cottage roof facing the drum being omitted to create a roof terrace. Opening slate finished apertures in the cottage roof allow west sunlight and views from the canteen. “With the best of intentions, you can only envisage so much at planning stage,” Michael Regan says. “You’re getting into the nuts and bolts of the scheme when the full design team are integrated. They’ve all their respective hats on, all pulling in the same direction as the client. That’s when these opportunities open up to the betterment of the project.”

The cedar wood drum which anchors the entire project was originally envisaged at planning stage as being formed entirely in glass with localised timber screening, but as the team worked through the plans and environmental ▶

(above) Close up detailing of the cylindrical wood drum’s cedar cladding; (below) a plan of the ground floor, showing the layout of the offices and the large warehouse at the rear; (left) the 2.5 storey drum anchors the entire project and was originally envisaged in glass, before the client opted to go for the timber design; (p57, clockwise from top) discrete movable slate panels provide light and views to the terrace without imposing; the building’s 217 sq m solar PV array and Supergrund insulated foundation system.



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details and calculations, it was clear that in addition to threatening the budget, glare and overheating issues would inevitably require that substantial expanses of the glass drum be obscured. Bart Arnold, very much a hands-on client, opted instead for the oiled cedar finish. Not alone did it achieve the aesthetic he wanted, but it also added to the timber used in the build, which was another project imperative.

At tender stage the invitations to tender were based on block work built details and specifications, but timber frame pricing was also invited as an alternative. MMD Construction won the contract based on a block built structure, Michael Regan explains. It quickly emerged however that suspending the drum on block would lead to an assortment of engineering headaches and potential thermal bridge details. Post tender MMD proposed a timber frame structure which made the engineering work considerably easier.

Passive design always favours the lowest surface area to volume ratio as possible. The dispersed layout of the TVM building required substantial attention to detail, both in terms of achieving airtightness and eliminating thermal bridges – two of the central challenges of passive house. A Supergrund insulated foundation underlies the three office buildings, eliminating thermal bridging issues at ground level.

Joe Blair of MBC Timber Frame who supplied the frame for the three office structures – cottage, drum and two-storey – says that this element of the build passed off without a hitch. “We’ve done about sixty or seventy houses to passive standards at this stage,” he says. In Bartlemy, MBC provided a twin wall system, a 300mm twin wall pumped full of cellulose insulation from Cork-based manufacturer Ecocel.

The building is accessed via a contemporary zinc-clad, glass-panelled entrance porch, which is positioned outside the thermal layer, and leads to a naturally-lit double-height entrance foyer. The office suites inside are centred around a bespoke triple-glazed roof light, which provides daylight down to ground level. The board room, offices and canteen area at level one are accessed from a steel and glass staircase concentric to the drum itself. The engineering workshop is clad in an architectural panelling system and provides accommodation for servicing and support for the company’s large mobile recording studio trucks.

Heating comes from an air to water heat pump system, while a 6 sq m flat plate Daikin solar thermal array assists with hot water needs. Hugh Foley of RTS Heating & Cooling supplied the building’s renewable heating systems, including a Daikin Altherma 16 kW low temperature air to water heat pump, with a certified SPF of 355%. “Obviously it’ll do a lot higher in hot weather, and lower in very cold weather,” says Hugh Foley. “Hot water demand takes priority on the heat pump. Ultimately down the line if they wanted to put a cooling coil onto the HRV unit – which would be a small modification – this heat pump model has the potential to be reversed for cooling.”

Foley also connected the heating technology to the building’s two heat recovery ventilation units – one for the toilet block, one for the rest of the building – both have water battery heaters built in, which are supplied hot water by the heat pump. The toilet block is heated to 18C. The design temperature for the rest of the building is 20C. “The controls on them are integral,” Hugh says. “If there’s a heat demand over and above what the MVHR is able to do, they send a signal to the heat pump to provide low pressure hot water to the heater batteries. That’s modulated by two 3 port valves on the pipework to the MVHR.”

Rainwater harvesting has been provided, primarily for truck cleaning and grey water recycling for toilets. Sensor flow taps have been fitted in bathroom basins and staff showers and there is PIR lighting throughout circulation and all non-office areas.

Completed now since May 2012, Michael Regan acknowledges that there have been the inevitable teething issues as people get used to working in a new space. “It’s no surprise in open plan offices that some users are very happy with their environment whereas some are cold at 20 degrees. The client has come from a bungalow across the yard. It had cubicles and I’ve no doubt that they had little blow heaters that could have cranked up the heat when they wanted, so there’s a certain amount of personal adjustment required from each worker. However the design team and subcontractors acknowledge post occupation that there have been temperature and ventilation balancing issues that required adjustment and seasonal monitoring over the first 12 month cycle.”

Both architect and M&E engineers Malachy Walsh and Partners have been monitoring the building closely over the past twelve months, with passive house specialists Wain Morehead Architects brought in to assist with finalising commissioning and to iron out any thermal comfort issues that were being experienced. According to John Morehead, PHPP – including site specific climate data – is being used in this case as a design review tool to assess the building’s performance in passive house terms to assist with the final commissioning of the overall system, rather than to achieve passive house certification.

“Using PHPP, we were able to focus on a number of key areas that might need adjustment,” John says. “Through the use of strategically positioned data loggers, the results of any resultant tweaks can be closely monitored.”

According to John, while the building fabric is streets ahead of conventional non-domestic buildings, particular attention needs to be paid to addressing and redistributing localised internal gains specific to the nature of business for a company like TVM, such as in the server room. “We found that the performance of the building envelope was well up there in passive house terms,” he says. “But the impact of internal gains and radiant asymmetry on comfort could be significant. It’s interesting to note that the internal heat gains were some six times that of solar gains, and wouldn’t necessarily be evenly distributed throughout a building of this type. The balancing of heat distribution and air quality through the use of the HRV systems in this building type is of paramount importance.”

Some overheating has occurred as the building beds in, most notably during the hot spell during the summer of 2012. According to Michael Regan, this has involved refocusing the supply and extraction of air to get a better balance between the heat sources – such as the server room, which was generating more heat than anticipated as TVM’s server equipment was finalised – and ▶

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the open plan areas. “Data loggers have been installed in three locations within the building and the design team are to use the information provided to make final adjustments to the location and redeployment of air extract grilles to maximise air-movement and heat transfer within the building.” he says.

Bart Arnold points out too that the situation is complicated by large variations in occupancy from one day to the next. “You can have a base level of 15 but then it goes up to maybe 50 because on weekends, most of the staff are out on the road working, so it’s not that we have an office that has 40 people here nine to five. There are quite a number of unique features here as we learn how to use the system.”

He has no doubt however that with a little further experimentation, these issues will be thoroughly ironed out. “We’ve made big progress over the last few weeks and the building performed much better during the recent heat wave,” Bart says.

“We wanted to design and build a building that was different, number one, and then as ecologically friendly as we possibly could…We’re happy in the work environment we have here. It’s an ongoing learning curve, and from that point of view it’s an interesting challenge in itself.”

SELECTED PROJECT DETAILS
Client: TVM Television Mobiles Ltd
Architect: E-Project Chartered Architects Ltd
Civil, Structural & M & E engineers: Malachy Walsh and Partners
Quantity surveyors: Michael Barrett Partnership
Main contractor: MMD Construction Ltd.
Mechanical contractor: Integral Mechanical
Electrical contractor: Fusion
Airtightness tester: Premier Energy Rating
PHPP analysis: Wain Morehead Architects
Heating & ventilation: RTS Heating and Cooling
Timber frame: MBC Timber Frame Ltd
Wall insulation: Ecocel
Windows, doors & roof lights: Window and Door Co. / Duggan Systems Ltd
Photovoltaic supplier: PV Tech
Insulated foundations: Kingspan Aerobord
Cellulose insulation: Ecocel
Airtightness products: Siga
OSB: Smartply
Heat pumps: Daikin
MVHR: Air Trade Centre
Cladding supplier: J P Corry
Green cements: Cronin Concrete
Flooring: Experto Flooring

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This content is exclusively available to our digital subscribers.

PROJECT OVERVIEW:

Building type: 1250 sq m office and workshop building

Location: Bartlemy, Fermoy, Co. Cork

Completion date: client handover in May 2012

Budget: Circa €2.1m construction costs

Passive house certification: not certified

Space heating demand (PHPP): 9.75 kWh/m²/m² – based on preliminary PHPP analysis. Note – the impact of internal heat gains on the low space heating demand is significant.

Heat load (PHPP): preliminary estimate of 10.95 W/m² based on incomplete data

Primary energy demand (PHPP): not established

Airtightness: mid construction test result of 0.521 ACH

Renewable heating system: 16 kW Daikin Altherma low temperature air-to-water heat pump with an EN14511-2:2000 certified SPF of 355%, combined with a 6 sq m Daikin flate plate solar thermal array with hot water priority, feeding water battery heaters in the MVHR system subject to demand.

Ventilation: two Caladair Carma mechanical ventilation systems with heat recovery. Counter flow heat exchangers with an EN 308 certified efficiency of greater than 90% under the following conditions: fresh air -10C / 90% RH, - Return air 20°C / 50% RH.

Electricity: a 217 sq m 32.5kW Hanwha Q-Cells Q.Pro solar photovoltaic array, with three 3-phase 10kW Steca grid tie inverters.

BER: not available

Ground floor: Supergrund insulated foundation and rising wall with 150mm structural concrete floor slab on three layers of 100mm thick EPS 100 insulation on radon barrier. U-value of 0.15 predicted from preliminary PHPP analysis.

Rendered walls: factory built 300mm wide twin walled timber frame system filled with Ecocel cellulose insulation with Siga airtight membrane and tapes used throughout. 12.5mm plasterboard finished 50mm wide services cavity provided inside the thermal/airtight break. 9mm thick OSB sheeting to 50mm air cavity provided between timber frame and external blockwork finished in acrylic self-coloured render system. U-Value: 0.125 (predicted from preliminary PHPP analysis).

Timber clad walls: factory built 300mm wide twin walled timber frame system filled with Ecocel with Siga airtight membrane and tapes used throughout. 12.5mm plasterboard finished 50mm wide services cavity provided inside the thermal / air tight break. 9mm thick OSB sheeting to 2 x 75mm ventilated cross battened cavity supporting 20mm thick lapped cedar boarding. U-Value: 0.126 (predicted from preliminary PHPP analysis)

Roof to main office: Siga air tight membrane to underside of 300mm deep structural timber I-beam section and 90mm rafter zone filled with a total of 390mm of cellulose insulation and 18mm OSB sheeting, with 20mm thick asphalt roof finish laid to minimum falls. U-value: 0.104

The roof to the roof terrace is of a similar construction, but excludes the 90mm rafter zone and 90mm cellulose insulation. U-value: 0.14

Windows: Viking Aluclad triple-glazed units and external doors. Argon gas-filled units providing an average U-values of 0.87 for fixed units and 0.90 for multi-paned units with tilt and turn opening sections.

Green materials: American red cedar cladding, Ecocel cellulose insulation, 50% GGBS cement in foundations

1970s Devon home

becomes certified passive B&B

Photos: Malcolm Baldwin / Passivhaus Homes

If you've ever wondered what it's like to live in a passive house, a B&B in Devon could be just the ticket. The winner of the private housing award at the 2013 UK Passivhaus Awards, this upgraded 1970s home proves that even existing buildings can be made passive.

Words: Lenny Antonelli

This bold retrofit project may be in Devon, but the story behind it starts in Wales.

That's where architect Janet Cotterell of CTT Sustainable Architecture met IT professional Adam Dadeby. Both were studying for a masters in advanced environmental and energy studies at the Centre for Alternative Technology, Machynlleth.

Adam's interest in energy policy had attracted him to the masters. But as time went on, the architectural side of the course drew him in.

Concerned about energy security and climate change, he planned to sell his London home and move to the south-west of England to build a low energy, ecological home. The passive house concept hooked him.

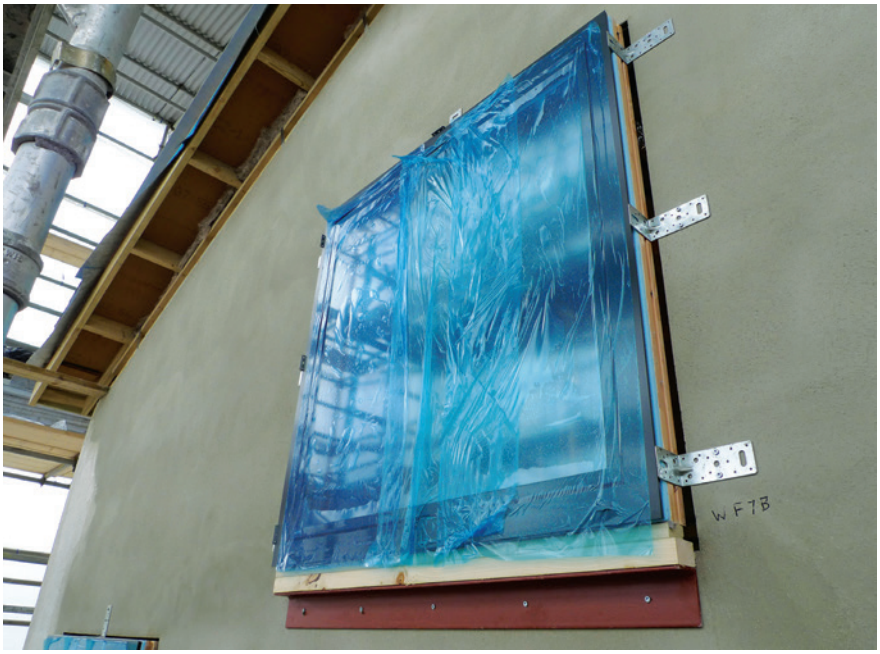
"It's very evidence based, and it's pragmatic," he says. "I'm not a very hair-shirt green, I like to be comfortable."

His initial plan was to build new, but the difficulty of finding land and getting planning permission nipped that in the bud. Together with his wife Erica, he bought a run-down cavity-wall house on a modernist estate in Totnes, Devon, and planned to retrofit.

"I can't think of any part of the house that wasn't wrecked," he says. "Except for total structural collapse, everything else you could think of was a mess." Enerphit, the Passive House Institute's less onerous standard for retrofit, didn't exist at the time, so Adam aimed for full passive house certification.

He interviewed other architects, but ended up hiring Janet. The two interviewed a handful of builders and – rather than going to tender – selected Jonathan Williams, whose background is in conservation building, and negotiated a price with him. "Jonathan understood what passive house was all about," Adam says. According to Janet, Jonathan was the only builder they interviewed who had read up on passive house, and understood how hard it would be. "Jonathan's conservation background meant he knew to take care," Janet says. "And he had a team of trades that he worked with regularly, which helped greatly."

The first step was to externally insulate the house. Adam wanted to use a natural material, but doing so would have resulted in very thick walls. What's more, the team couldn't heavily insulate the ground floor (though they did put in 80mm of phenolic and 20mm of woodfibre insulation here) without lowering the room height or undertaking expensive groundworks. So in order to hit the passive house standard, they had to compensate by pushing the thermal performance ▶



of the walls even further.

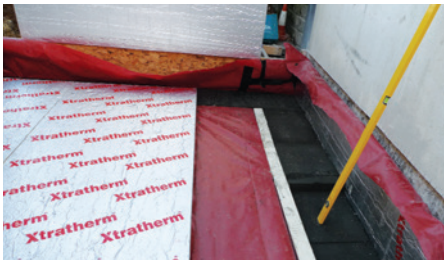
That meant using a high performance, synthetic insulation — 180mm of Kingspan K5 phenolic board — rather than a natural material. The external insulation helps to eliminate thermal bridging too.

The existing wall cavity was filled with polystyrene Instabead, while insulating autoclave aerated concrete blocks were used to rebuild and extend wall sections that were close to collapse. Upstairs, the team extended the building upwards to add a third floor and insulated the new roof with Warmcel cellulose insulation – made from recycled newsprint – plus Thermafleece sheep's wool in the service cavity.

Janet designed a new 30 square metre timber frame extension that serves as an entrance area. The walls and roof feature Warmcel-insulated Steico I-joists plus sheep's wool-filled service cavities. There's also a "living roof" planted with local wildflowers.

"I just like the idea of the small section timber I-joist, using low grade timber, and using as little of it as possible, and using the recycled newspaper [insulation]. It just seemed a sensible use of materials to me," Janet says.

(above left) Windows are bracketed onto walls prior to external insulation installation to ensure a continuous insulation layer; (above right) south facade with completed insulation before rendering; (below, clockwise from top left) Foam Glas insulation under the toe of the slab with 200mm Xtratherm PIR; Steico I-joists form the roof structure; view down towards south west including 50mm existing cavities; airtightness taping around joists; (p63, above, left to right) architect Janet Cotterell & client Adam Dadeby receive the passive house certificate from builder Jonathan Williams, pictured with build team member Joe Bellows with passive house certifier Peter Warm); (below) the extension features a living roof; and bright, sleek yet ecological kitchen.



The whole house scored 0.40 air changes per hour on its first airtightness test, and a jaw-dropping 0.2 at certification.

According to Janet, this result is down to meticulous detailing and education across the project team. "We didn't end up having an airtightness champion because everyone was the airtightness champion," she says. "Everything was very carefully planned, so that virtually no changes were needed on site."

The team chose triple-glazed Internorm Varion units and Varion 4 '2 + 1' units, which feature double-glazing plus an integrated blind — to control overheating — that's enclosed by a third pane of glass.

These later units have an average overall U-value of 0.93, which may not be sufficient for passive buildings in colder climates, but are suitable for mild south Devon.

Janet paid close attention to shading design, and says the house stayed cool during this summer's heatwave. "We did the shadings quite well. It's one thing with PHPP you can fudge a bit," she says. Designers must get shading right to prevent overheating, she says, otherwise people will say the passive house concept doesn't work.

"The house is very comfortable and our bills are very low," Adam says. Internal temperatures are steady, and when they change they do so very gradually. The only major overheating problem occurred when over 150 people attended an open day at the house during a spell of warm weather.

But during the cold winter of 2012, the ground floor was actually a little cooler than upstairs — most likely because the floor is only insulated to a U-value of 0.2, and because there's a thermal-bridge at the wall-floor junction.

Janet says there's an important lesson here: that while passive house designers can compensate for less-insulated surfaces by adding more insulation elsewhere, for comfort every opaque surface in the external envelope should ideally hit the recommended maximum U-value of 0.15.

The house's only source of mechanical heating is the heat recovery ventilation system, which ▶

includes a small duct radiator in the supply air that's fuelled by a little gas boiler. Adam's thinking of adding a radiator downstairs to deliver more heat there, but might take out the duct heater if he does.

"I was quite determined not to have radiators, and I should have been more pragmatic," Adam says. He admits that not installing a full central heating system was akin to taking a leap of faith.

But he's still very comfortable — during his first winter the duct heater had yet to be installed, but he heated the whole house to about 19C with a small oil-fired radiator on its lowest setting (400W).

Solar thermal panels contribute to the house's hot water, and Adam also installed a solar photovoltaic array with a 4kW peak output. He installed PV partly for environmental reasons, but also because the feed-in tariff on offer at the time was quite generous. "Purely in money terms it was worth it," he says.

But the solar thermal and PV panels are facing west and east respectively, a constraint of the planning conditions. "Our wintertime renewables generation is consequently much lower," Adam says.

Perhaps surprisingly, in hindsight he's unsure whether such a deep retrofit is always the right solution for projects like his — in economic or environmental terms.

Building a new house, he reckons, would have cost less (principally because he would have got a big VAT discount for new build). And in carbon terms, he would have been able to use natural, low embodied energy materials throughout the build.

Nonetheless, the project won in the private housing category at this year's UK Passivhaus Awards and the whole Totnes team — Adam, Janet, Jonathan — went on to collaborate on various projects.

The trio have since founded Passivhaus Homes, a design-and-build passive house firm that is developing a 'kit-based' approach to building passive homes to bring costs down. They've just completed their first prototype. The company is also looking at working with community land trusts to develop new, affordable passive homes.

"We feel this is a much better way to deliver low cost housing to the people who need them," Janet says. "It cuts out the commercial profit driven volume house builders and puts the local community back in the driving seat."

The trio have also launched a web business, the Passivhaus Store, which aims to streamline the supply of passive house suitable building materials and systems. Adam and Janet have also written The Passivhaus Handbook, which is published by Green Books/UIT. "The book is a distillation of what we've learned from the project," Adam says.

Meanwhile, Adam and his wife Erica have opened up their Totnes passive house as a bed and breakfast. Adam says half their guests are people thinking of building their own passive house, visiting to get a taste of what it's like to live in one.

So, if you really want to get a feel for the project, you could always go and check it out for yourself.

Adam blogged extensively about the project at http://passivhausrefurb.blogspot.co.uk

SELECTED PROJECT DETAILS
Client: Adam Dadeby & Erica Aslett
Architect: CTT Sustainable Architect
Contractor: Williams & Partners
PHPP: Adam Dadeby
Passive house certification: Warm
Airtightness consulting & testing: Aldas
External insulation (retrofit): Kingspan
Cellulose insulation: Warmcel, installed by Ecofill
Sheep's wool insulation: Thermafleece
Wood fibre insulation: Steico
Cavity wall insulation: Instabead
Insulated foundations: Celotex
Airtightness products: Ecological Building Systems
Windows: Internorm
Masonry thermal blocks: Travis Perkins
Thermal breaks: Foamglas
Plaster: British Gypsum
MVHR: Paul
Solar thermal & modulating boiler: Rotex, supplied by Responsible Energy Management
PV array: Mobasolar
PV inverter: Fronius

PROJECT OVERVIEW:

Building type: 162 square metres retrofitted & extended cavity-wall detached house including 30 square metre timber frame extension.

Location: Totnes, Devon

Cost: £330,000 construction plus £44,000 for architectural and other professional fees

Passive house certification: full certification achieved

Space heating demand (PHPP): 13kWh/m²/yr

Heat load (PHPP): 9.3W/m²

Cooling load (PHPP): 4W/m²

Primary energy demand (PHPP): 68kWh/m²

Primary energy demand (measured): 76kWh/m²

Airtightness: 0.2 ACH

Upgraded walls: 180mm rendered Kingspan K5 phenolic external insulation on 100mm original block, followed inside by 50mm cavity insulated with Instabead Graphite K32, then another 100mm block. U-value: 0.095

Upgraded ground floor: 14.5mm Kährs hardwood floor finish on 2mm foam underlay, followed underneath by 20mm Steico woodfibre insulation, 80mm Kingspan K3 insulation, 10mm plaster and original 150mm slab. U-value: 0.2. Glapor foamed glass gravel insulating aggregate outside three perimeter walls.

New roof on existing dwelling: 24mm woodfibre board externally, followed below by I-joists with 350mm Warmcel cellulose insulation, 50mm service cavity insulated with sheep's wool, plasterboard. U-value: 0.104

Extension walls: 24mm woodfibre board externally, followed inside by vertical I-joists insulated with 400mm Warmcel cellulose insulation, 50mm sheep's wool-insulated service cavity, and plaster board internally. U-value 0.093

Extension floor: Kährs hardwood floor as above, on 20mm Steico woodfibre insulation, 50mm sheep's wool batts, 150mm slab, and 200mm Xtratherm PIR insulation. Two courses of Foamglas Perinsul blocks at perimeters under toe of slab. U-value: 0.075

Extension roof: OSB board externally, followed below by I-joists with 350mm Warmcel cellulose insulation, 75mm sheep's wool insulated cavity, and 12mm plasterboard. U-value: 0.107

Windows: Internorm Varion triple-glazed windows/ Varion 4 '2 + 1' glazing. The Varion 4 units have integrated blinds for summertime shading. Spacer-psi value 0.05W/mK, g-value 0.6 on solar gain facades, double e-coated, Argon filled. Overall U-values: 0.75-0.93

Heating: post heater in MVHR supply air fuelled by 20kW Rotex gas boiler (modulates down to 4kW). Plus 9.4m² of west-facing Rotex roof-integrated solar thermal drainback panels with Rotex 500 litre thermal store.

Microgeneration: 3.99kWp Mobasolar photovoltaic array with Fronius IG TL transformerless inverter

Ventilation: MVHR Paul Novus 300, 0.24Wh/m³, 93% HR efficiency

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CORK HOME

hits 94% heat reduction with Enerphit

The vast majority of energy upgrade projects aim for low hanging fruit measures, and risk locking buildings and their occupants into needlessly high energy usage, environmental impact and discomfort. This recent home upgrade on the outskirts of Cork City shows what truly deep retrofit looks like.

Words: John Hearne

Prior to Elite Architect's renovation of a 1950s house in Co Cork, architect Andrew Shorten used passive house software to estimate its annual heating bills. When the figure came in at a staggering €5,500, he did a double-take.

"It sounded a lot," says Shorten, "but when I thought about it, my own rule of thumb for a ten-year old house built to building regulations is that it costs about a Euro per square foot per year to heat, and this house is 1950s, single glazed with zero insulation and 2,500 sq feet. That €5,500 mightn't be far off."

When Shorten performed the calculations again after the renovation, he found that the cost of heating the house had fallen to just 6% of the original figure.

The drive for Enerphit, the Passive House Institute's standard for renovations, came from Elite. Shorten says that he simply recommended that approach for the job and the client agreed. "At the time they were renting an old house in Blackrock in Cork. I was talking about an airtight house, and they had drafts coming up from under the floorboards, so they were able to contrast what we were aiming for with the wrong end of the spectrum."

While Enerphit standards are not as exacting as passive house, design professionals will tell you that achieving those standards can actually be more challenging. A new build offers a wider choice of design and construction options. When you have to work with and retain large sections of what's already there, it frequently requires more imagination and a more exacting spec to hit the targets.

"There was a rustic character to the house, particularly as you approach from the road, and we felt we didn't want to lose that character," says Shorten. "It hadn't been touched in years, so it needed a significant overhaul in terms of performance, electrics, plumbing, heating, insulation and aesthetics, and we also needed to transform it into a tasty house to live in. In fact, it was kind of obvious what the brief was."

One thing the project had in its favour was orientation. The living areas of the house already faced south, benefiting from passive solar gains. To increase those thermal gains still further, an extensively glazed one room extension was added. A sloped garden facilitated dropping the floor level here, allowing the design team to create a four metre high living space surrounded by a double-height glazed wall. In order to both connect outside and inside, and to provide summer shading, an overhang was created at this elevation.

Contractor the Green Build Centre had worked on passive house projects before, but this was ▶

their first Enerphit renovation. “We were very lucky to be honest,” says project manager Mark Higgins, “because basically the house was stripped back bare. In that respect we had a blank canvas to work with. We stripped out the whole building, ceilings – the lot.”

Retaining the external look of the house meant ruling out one approach that tends to feature prominently in Enerphit projects: external insulation. But because it was such a big, boxy house, there was sufficient room to accommodate additional insulation internally.

The team then turned its attention to eliminating cold bridges and achieving airtightness. Andrew Shorten points out that external insulation, in addition to affecting the house’s character, can add a further challenge in a retrofit situation. “With external insulation, there’s now a huge gap between that insulation and the insulation under the floor.”

Shorten argues that insulating internally put him in a better position when it came to designing away cold bridges. Cutting away all floors and ceilings allowed the contractor to completely dryline internal walls. Installing new insulation beneath the floors and in the roof then allowed the team to effectively create a continuous, almost unbroken layer of insulation inside the house.

“If you draw a section through the house,” Shorten explains, “floor meets wall perfectly, wall goes through first floor perfectly, bar timber joists bridging, which isn’t a major deal. Then it goes up and meets the 450mm of attic insulation.

“All of the internal walls meet the external walls, creating a break in the insulation but we pumped the cavity with 100mm of bead, so that thermal

bridge was nullified by the fact that there was more insulation out beyond it. It meant the compromise there was really minor."

Airtightness was then achieved through a combination of OSB board and Siga tape. As has become increasingly common now, the build contract was subject to a substantial retention – in this case €30,000 – on achieving airtightness.

"We have a system where one person is in charge of the airtightness from start to finish on the project," says Mark Higgins. "That one person is basically onsite all the time. He's project leader."

"When a trade finishes he'll inspect, and he'll advise before the trade starts as well. When you tell people that airtightness can cost anything between €5,000 and €10,000 they really don't understand why – sure it's only tapes and plastic. They don't understand the amount of labour that goes into achieving it."

He adds that he treats airtightness as a process, and that he doesn't tend to make any money on that aspect of the build. The first and only airtightness test recorded 0.9 ACH, comfortably within the Enerphit limit of 1 ACH.

Heat now comes from a gas boiler, while a heater battery in the mechanical heat recovery ventilation system provides backup. "Because the extension is virtually all glazed apart from one wall," says Shorten, "there was a risk of it being vulnerable to cold in the winter because of excessive heat loss, so that area has a separate zone heated by underfloor heating. We've found that that works perfectly."

The new triple-glazed windows from Slowinscy deliver overall U-values of 0.7, while a bespoke rooflight over the office area, put together onsite by the contractor, was also designed to meet a 0.7 U-value.

Despite achieving Enerphit standards, so far neither client nor architect have opted to seek certification from the Passive House Institute. "It wasn't high on our priority list." Shorten admits. "But it's at the standard. While we may go for it in the future, we haven't pushed our client to get certification because it's an expensive process."

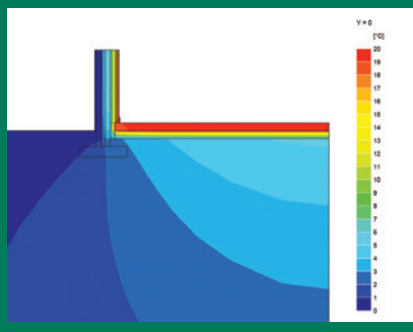
The clients are now in the house for seven months. There has been the usual adjustment period as they get used to how a passive space works. "I think it takes a little getting used to from a client's point of view. We've experienced that with other clients as well. Once they're in the house six months and they understand things, they get happy with it."

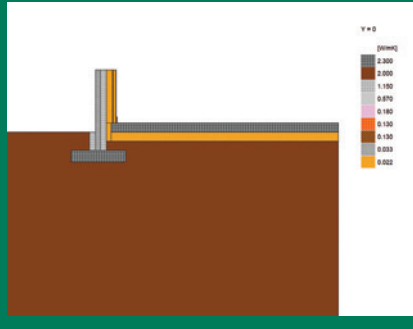
"The whole project went quite smoothly," says Mark Higgins. "The architects were onsite every week which is very important. If you have a problem, it can be dealt with quickly. The biggest watch-out factor is that everyone is talking all the time, and everyone understands what's happening next."

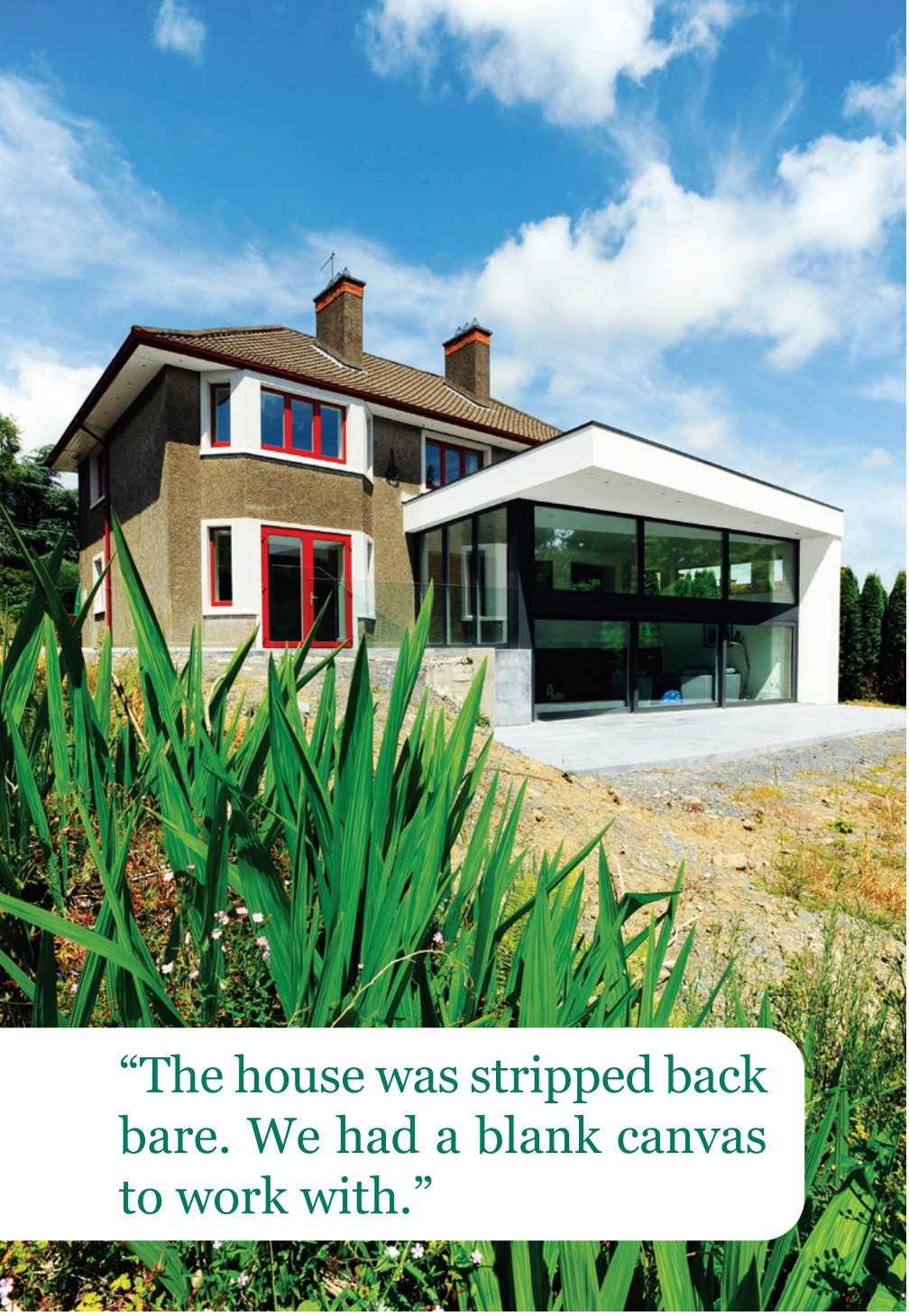
SELECTED PROJECT DETAILS
Clients: Anonymous
Architect/passive house consultant: Elite Architects
Engineer: Foundation & Design
Main contractor: Green Build Centre
Energy rating assessment: Brian Ronayne
Heat recovery ventilation:
ProAir, installed by Munster HRV
Insulation to floor and walls: Xtratherm ▶

To shed some light on how thermal bridging calculation varies between Ireland and the UK's national methodologies and the passive house approach, insulation manufacturer Xtratherm's Mark Magennis carried out some thermal bridging modelling of the wall-ground floor interface detail in this building. Qualified under the BRE and NSAI schemes to carry out thermal modelling assessment in Ireland and the UK, Mark's modelling reveals strikingly different results for the same detail. Deap and Sap – respectively the Irish and UK methodologies for determining compliance with minimum energy performance standards under building regulations and for generating energy ratings – model thermal bridging based on internal measurements. The Passive House Planning Package (PHPP) takes a different approach, using external measurements. As a consequence, in this case the same detail shows a Psi-value of 0.049 to input into Deap and Sap, or 0.0022 for PHPP.

"In reality it's the same amount of thermal bridging," says Xtratherm's Danny Kearney. "PHPP seems daunting because the thermal bridging targets of 0.01 seem so low but as we head towards zero energy and zero carbon standards, the requirements in our national methodologies set more onerous PSI-value targets, so passive house thermal bridging performance can be achieved using reasonable specifications. When you actually do the conversion from national methodologies to PHPP, you may be surprised - you may have achieved a better Psi-value than you thought."







"The house was stripped back bare. We had a blank canvas to work with."

Cavity wall insulation: Thermobead, installed by Dungarvan Insulation
Roof insulation: Knauf
Airtightness products: Siga
OSB: Smartply
Breather membrane: Ecological Building Systems
Thermally broken cavity wall ties: Ancon
Windows & doors: Slowinscy
Roof windows: Cork Glass/Velux
Condensing boiler: Vokera
Kitchen/fitted furniture: Creative Designs

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(above) As the living areas of the house were south-facing, an extensively glazed extension was built to make the most of the solar gains. The sloped garden facilitated in dropping the floor level, allowing the design team to increase the height of the extension; (p67, clockwise from top left) airtightness was achieved through a combination of OSB board and Siga tape; Knauf Earthwool insulation in the flat roof of the extension; an overhang provides summer shading.

PROJECT OVERVIEW:

Building type: renovation and extension to a 1950s detached house

Location: Cork

Completion date: December 2012

Budget: confidential

Enerphit certification: application has not yet been made.

BER (before): unknown
BER (after): B1 (92.68 kWh/m²/yr)

Space heating demand (PHPP)
Before: 226 kWh/m²/yr
After: 12 kWh/m²/yr

Heat load (PHPP)
Before: 103 W/m²
After: 11 W/m²

Airtightness (at 50 Pascals)
Before: Unknown
After: 0.92 ACH

Original walls
Before: blockwork with un-insulated cavity. U-value: 2.0
After: platinum EPS insulation to existing 80-90mm cavity; 100mm Xtratherm Thin-R PIR insulation internal drylining; Smartply OSB airtight/vapour control layer with all joints taped with Siga tapes; 38mm Xtratherm PIR insulation; plasterboard with skim finish. U-value: 0.11

Extension walls: blockwork with 100mm cavity pumped with full fill bead insulation, TeploTie low thermal conductivity wall ties; 100mm Xtratherm Thin-R PIR insulation internal drylining; OSB airtight/vapour control layer with all joints taped; 38mm Xtratherm Thin-R PIR insulation; plasterboard with skim finish. U-value: 0.11

Existing roof
Before: pitched, hipped A-frame roof to existing house with concrete roof tiles. U-value: 2.3 W/m²K
After: PVC single ply roofing membrane; 300mm mineral wool insulation on the flat between existing roof joists vapour barrier; 50mm service cavity; plasterboard ceiling. U-value: 0.09

Extension roof: PVC single ply roofing membrane; single ply membrane finish; WBP plywood; 50x50 battens to create ventilated void; Pro Clima Solitex Plus breather membrane; Firring pieces to create falls; 425 mm Eco joists with 450mm Knauf Loft roll between joists; Siga Majpell vapour barrier and tapes; 50x50 battens to form service cavity; plasterboard with skim finish; U-value: 0.11

Floor: original suspended wood floor removed, roughly 400mm of 804 aggregate imported and compacted; radon barrier; 150mm of Xtratherm PIR insulation; 150mm concrete slab. U-value: 0.11.

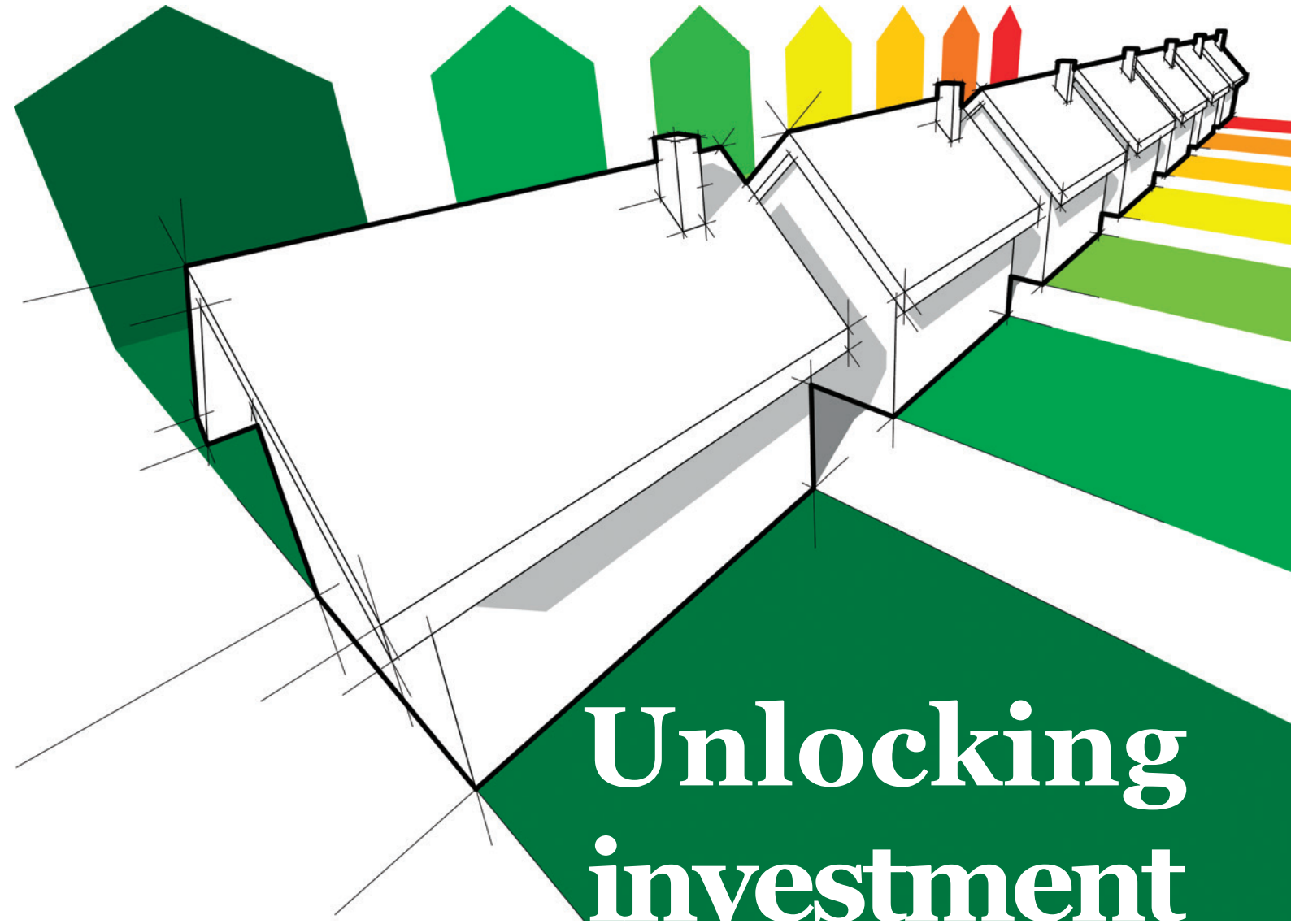
Thermal breaks: 100mm wide strip of Xtratherm PIR fixed to the base of the external wall at 300mm beneath floor level, meeting 150mm of Xtratherm laid horizontally beneath 150mm of concrete – and used to level concrete pour.

Windows & doors
Before: single-glazed, aluminium windows.
After: new triple-glazed Slowinscy Thermax Ultra timber alu-clad windows. Overall U-value: 0.70

Roof windows: triple-glazed unit to flat roof from Cork Glass. U-value: 0.7. Velux triple-glazed rooflight. U-value: 1.0

Heating system
Before: existing boiler and radiators throughout entire building
After: Vokera Combi gas boiler, 97% efficiency, underfloor heating to extension only. Heating battery in ventilation unit, with heat distributed through HRV system to all rooms.

Ventilation
Before: no ventilation system. Reliant on infiltration, chimney and opening of windows for air changes.
After: ProAir PA 600 HRV with Sap Appendix Q rated efficiency of up to 94% and specific fan power down to 0.57 Ws/l, with in line heating battery fabricated by ProAir.



Unlocking investment IN HOME RETROFIT

Lessons from the UK and Ireland

Image: Slavo Valigursky

In spite of a consensus that most buildings need deep energy upgrades, both Ireland and the UK have barely scratched the surface. **Joseph Curtin** – one of Ireland's leading energy policy wonks –discusses how to kick start en masse upgrade work.

It makes sense to retrofit buildings. Economic output is increased, jobs are created in the dormant construction sector, and exchequer finances are bolstered.

Investing in buildings is also unquestionably the key to unlocking the near-term decarbonisation challenge in the UK, Ireland and many other European countries. Broader benefits include greater asset values, increased productivity and competitiveness, fuel poverty alleviation, greater energy security, and reduced government health expenditure.[1]

Investments in the homes are particularly labour intensive. Yet it's difficult to convince homeowners to take action. Efforts to promote investments face intractable challenges, often resulting in only slow or marginal behavioural change on the ground.

The installation of grant-supported cheap measures with short paybacks prevails. Deeper more comprehensive retrofits, which in many cases constitute an excellent investment proposition, remain something of a white elephant – much talked about, but rarely encountered.

A central issue surrounds the shortage of up-front investment cash, sometimes referred to as a financial barrier. This barrier interacts with a number of complicating behavioural, cultural, social, and informational barriers. Where deeper retrofits are concerned, with payback periods sometimes in excess of 20 years, the split incentive is also an issue – the investor may sell on the property in due course, and the next homeowner becomes the beneficiary.

An emerging trend, particularly in the UK and Ireland, is a shift from grant-based support. The objective is to establish a sustainable market-based approach to retrofit, with minimum exchequer support. This is a welcome development – grant programmes result in boom-bust investment

cycles, and are dependent on scarce exchequer resources. But ensuring a smooth transition from grant programmes which incentivize shallow retrofits, to market-based approaches aimed at promoting deeper retrofit activity, is fraught with difficulties.

UK green deal or no deal?

The UK has taken the lead. The much-discussed Green Deal attempts to address the financing barrier by providing up-front funding to interested homeowners who want to invest in efficiency. They repay the loan as they save money on energy bills over the years.

The electricity bill payer repays the investment, so that if a home is sold, the new owner takes on responsibility for the repayment stream (optionally, the loan can be repaid at this point). This is a key enabler of deeper retrofit activity.

Since the programme went live earlier this year, the number of homes installing cavity wall insulation and other measures declined significantly. Households used to receiving heavy subsidies for measures are understandably reluctant to take out what's perceived as a personal loan.

While short-term teething problems shouldn't cause concern, well-intentioned critics say that the programme is flawed. They argue that money is too expensive, with interest rates of seven per cent the norm. This compares unfavourably to mortgage products, which are becoming increasingly common in the market place. For example, Ecology Building Society charge 3.9 – 4.9 per cent for mortgages for energy saving home improvements.

UK Department of Energy and Climate (DECC) survey data[2] shows that homeowners who have had a Green Deal assessment still cite finance as the biggest barrier – the one that this programme was supposed to overcome. Homeowners are clearly saying "no deal".

The principle of the debt attaching to the energy meter has also come in for criticism, with many arguing that it could act as a disincentive when it comes to selling the property. While sound in theory, this is certainly a new concept for consumers to grapple with. Like all such ideas, it'll take a lot of explaining before it's accepted in the marketplace.

If works are undertaken, however, this means a more valuable property, more comfortable living conditions and lower bills. Whether the seller pays off the loan, or the buyer takes it on, there will be a net benefit. I don't see this as a problem in the medium-term. While it would be foolish to ignore consumer feedback, the Steve Jobs maxim that "a lot of times, people don't know what they want until you show it to them" seems apposite.

Even if loans with competitive interest rates were available, critics in the UK have argued that this would not be sufficient to drive widespread retrofit. Because of the fundamental newness of the offering, and the cultural shift required, the UK Green Building Council have argued that "long term structural incentives would still be needed to ensure sufficient uptake".

Ireland's better energy?

Ireland too began with a grant-aided programme, which succeeded in breathing life into the residential retrofit industry. The numbers of houses undertaking retrofit under the Better Energy Homes scheme first rose dramatically between 2009 and 2011. Activity has, however, declined significantly in 2012 and 2013.

A close up view of platinum EPS bonded bead insulation. Up till now Ireland's grant funded energy upgrade work has centred on low hanging fruit measures such as pumping bead into cavity walls.

It should be noted that the average investment for a retrofit was €3,000, of which approximately €1,000 came from the grant. Although grants were available for "deeper" measures such as internal and external wall insulation, support was effectively targeted at shallow, cheap and "easy" measures: cavity wall insulation and roof insulation.

Funding for retrofitting is to be phased out by 2014 according to the Programme for Government, and a 'Pay As You Save' scheme, somewhat akin to the Green Deal, is to replace the grant programme.

Better Energy Finance, an industry-lead initiative which is working with government to design the scheme, offered some indication of the direction they will take. In a recent paper the group argued that "at this stage of the project we believe offering short payback measures is a key part of building consumer confidence in the scheme and introducing them to a journey of successive home improvements leading down a path to deeper retrofit". They also decided that the idea of attaching debt to the energy meter was not a runner – this is consistent with a focus on shallow retrofit with short payback periods.

While an overall design has yet to emerge, and it is too early to be critical of these developments, it would appear that the group envisages continuing the focus on shallow retrofit. Given that applications for these measures have collapsed even with the availability of a grant, prospects for the programme may be somewhat gloomy.

On the other hand, if energy utilities are required to meet part of their energy saving targets required under the EU Energy Efficiency Directive in the residential sector, there may be additional support available to homeowners via their energy companies. The Irish government has given no indication yet how it intends to implement the directive.

Four conditions for success

If the UK and Ireland are to succeed in the generational programme of upgrading the housing stock, action is required across a range of areas. Short-term political wins must be sacrificed for the objective of putting in place a programme which has the potential to deliver effectively over the coming decades. A number of lessons have been learned from experience to date, which can guide future policy development.

One: the cost of money and exchequer support

The first lesson is reminding us of something we knew already: seven per cent interest rates will not work. If financing cannot be provided at more attractive rates over 20 to 25 year terms, programmes aimed at promoting deep retrofit will fail. The point is illustrated by the case studies in tables 1 and 2, based on data from the Irish market. We can see that deeper retrofits are only attractive as an investment proposition if money can be provided at low cost over longer terms.

> "Withdrawing grants entirely and expecting a market-based approach to take off is unrealistic"

Related to the above points, it's likely that there will be a requirement for government support to overlap with financing offerings for a period of time. Withdrawing grants entirely and expecting a market-based approach to take off is unrealistic. Whether grants should be maintained (perhaps with an annual degression) ▶

Table 1: estimated cash flow from deep retrofits

Description	Estimated cost of measures €	Estimated annual savings €	APR %	Estimated annual cash-flow 20 Years €	Estimated annual cash-flow 25 Years €
1. External wall insulation, attic insulation, high-efficiency boiler & heating controls, solar panel	18,350	1,640	4	306	478
			10	-485	-361
2. Internal wall Insulation, attic insulation, high-efficiency boiler & heating controls, solar panel	13,950	1,544	4	530	660
			10	-71	32
3. Cavity-wall Insulation, attic insulation, high-efficiency boiler & heating controls, solar panel	9,450	1,496	4	809	897
			10	402	466

Source: IIEA (2011) calculations based on SEAI estimates for technology costs and savings. Technologies selected are those for which grant was available

or the cost of money is subsidised is a moot point, but some form of support must be provided. Another option is to provide support indirectly via energy suppliers, who are required to deliver energy savings under the Energy Efficiency Directive.

This shouldn't be a difficult sell to policy makers. The case study below (again from the Irish market) shows tax revenue to government from the installation of external wall insulation. Reduced social welfare and health spending are not considered, making this a low estimate.

diminishes. Interested householders are limited, as are the numbers of interventions available. This is particularly the case with cavity wall insulation where the majority of low hanging fruit may already have been picked. The only way to build a sustainable industry is by focusing on deeper retrofits.

Three: using property taxes as supplementary instruments

If we are to take this area seriously, a range of supplementary supporting measures are required to encourage the magnitude of the shift

Table 2: Tax take on installation of 123 sq m external insulation

	Taxable amount (€)	Tax rate (%)	Tax take (€)
Labour taxes (PAYE and PRSI) paid by installers	6,064	26.6*	1,618
Labour taxes paid by materials distributors	3,178	15**	476
Relevant contractors' tax (relevant to cills/pressings, transport & shipping)	1,500	35	525
VAT (on materials + labour + margin 10%)	11,816	13.5	1,595
Corporation tax on net profit	537***	12.5	67
Total tax take			4,281

Source: industry case study

* Combined weighted average of income tax and pay related social insurance
** The distribution margin is in the region of 30 per cent, 15 per cent assumed as tax take
*** Estimated at half gross margin

As we can see from the above, the grant available for external wall insulation (€2,700) is easily recouped by the exchequer.

Two: go deep or go home

As is also illustrated from the above example in table 1, bundling of measures with short paybacks (heating controls or attic insulation) with measures with much longer paybacks (external wall insulation) is required for packages to have reasonable payback periods. Programmes which cherry-pick loft and cavity wall insulations therefore can work against comprehensive retrofits, by making those interventions technically and economically implausible at a future date.

Additionally, we can see from the experience with Ireland's grant-aided programme that shallow retrofit programmes can only be sustained at a high level for a short period, before interest

in society which is required. While a range of discrete measures are required to target different market segments (such as social housing, rented accommodation, heavily mortgaged properties, apartments, houses and listed buildings), I'll focus on one.

We know from empirical evidence that consumers are somewhat myopic when it comes to future energy costs implicit in the purchase of an electrical appliance, a vehicle or a house. This is why we have regulations for the efficiency of electrical appliances, and why car purchase tax and annual car tax rates reflects the efficiency of vehicles. When these new calculation methodologies for vehicle purchase tax and annual tax were introduced in Ireland to incentivise efficient vehicles, the impact was an immediate: consumers shifted their car purchase decisions dramatically in favour of efficient vehicles.

In the UK and Ireland, houses are taxed in the same way as cars: there is a transaction tax at the point of purchase and a property tax payable annually. These tax instruments can and should be amended in a fiscally neutral manner to reflect the efficiency of houses; the impact would likely be equally dramatic.

Four: overcoming resistance in government

If success is to be achieved, policy makers must not be put off by the intractability of the challenge. A continued and determined focus, and the willingness to trial, test, and refine policy interventions is a necessary condition for success.

There is resistance in many parts of government, in particular in Treasuries, to investing in building energy efficiency. This is particularly the case in the current climate of fiscal retrenchment. This may be because the impacts and outcomes of investing in residential efficiency are considered somewhat uncertain.

By contrast, Treasuries prioritise more established areas of capital expenditure such as roads programmes. This is perhaps because these areas have a clearly defined and predictable outcome, and an established and accepted methodology exists where these outcomes can be established ex ante.

Policy resistance within governments can be overcome with greater evidence on the benefits of investment programmes. For example, Ireland's SEAI have undertaken a cost-benefit assessment of their investment programmes which show a benefit to cost ratio of 5:1 for society. A recent UK Department of Energy and Climate Change in the UK demonstrated that asset value appreciation alone may cover the cost of retrofit in many cases. These are positive developments which can be built upon.

Conclusions

Valuable lessons have been learnt from ongoing and past programmes aimed at promoting investments in home retrofit activity. Ultimately a cultural shift is necessary in society. A tipping point can be reached, where financing investments in residential energy efficiency is as common as financing the purchase of a new vehicle.

While the shift from grants to more market-based approaches to promoting deeper retrofits could be successful, more focused efforts across a range or areas is required. Government support is necessary for the transition, as are a range of supporting and flanking measures. Get this right, and the UK and Ireland can be trailblazers for other European countries.

Joseph Curtin (@jmcurtin) is a senior research associate with the Institute of International and European Affairs, Dublin. He has worked for the OECD, NESC (an advisory body to the Taoiseach), and the Sustainable Energy Authority of Ireland, on climate and energy policy-related issues.

[1]The multiple benefits of energy efficiency policy for Ireland are discussed in more depth in Curtin, Joseph and Maguire, Josephine, Thinking Deeper: Financing Options for Home Retrofit, Institute of International and European Affairs, Dublin, Ireland, September 2011. For more general discussion see: IEA (2012) Spreading the Net: the Multiple Benefits of Energy Efficiency Policy, IEA: Paris.
[2]bit.ly/14mxk4w

glossary

*Perplexed by all this talk of U-values, blower door tests and embodied energy? This latest instalment of our sustainable building glossary will help you get to grips with the key terminology. These entries will be added to an online glossary at **www.passive.ie/glossary**, which will continue to grow in detail as each new issue comes out.*

Air-to-water heat pumps use outside air as a heat source and delivers it to internal spaces via hot water (eg underfloor heating pipes) using electricity to boost the temperature.

BREEAM This is the Building Research Establishment's Environmental Assessment Method, a UK system used to assess the environmental impact of non-domestic buildings. It considers a range of criteria including energy consumption, water, materials, waste, transport, ecology, pollution and health. It has five levels: pass, good, very good, excellent and outstanding. As with competing rating systems such as the US LEED and German DGNB systems, BREEAM is gaining popularity internationally, often used by public sector and multinational clients.

Brise soleil A permanent structure designed to provide shade from the sun. In the northern-hemisphere these are often placed on a building's south-facade to help prevent glare and overheating. Some innovative approaches to brise soleil include planting deciduous climbers to provide extra summer shading and more passive solar gain in winter.

Building envelope/fabric The exterior 'shell' of the building, including the external walls, windows, ground floor and roof.

Code for Sustainable Homes The BRE's environmental assessment tool for dwellings. As with BREEAM (see above), buildings are assessed on their overall environmental performance, resulting in six levels of scoring.

District heating A type of heating system in which heat is piped from a large central heating system (such as a boiler) to multiple units (such as houses or apartments), rather than each unit having its own separate heat source. Often financed via energy service companies (ESCos), district heating systems tend to become less viable in very energy efficient buildings, given that the low space heating demand means smaller bills payable to the ESCos.

Enerphit This is the Passive House Institute's standard for retrofit projects. It demands airtightness of 1.0 air changes per hour and space heating demand of 25kWh/m^2/yr (as opposed to 0.6 air changes per hour and 15 kWh/m^2/yr for the original passive house standard).

Intelligent vapour check/membrane A type of membrane, often used in timber frame construction – and timber roof structures – that becomes more or less permeable to water vapour depending on ambient conditions. Typically in winter it prevents water vapour from getting in but becomes more vapour permeable in summer to allow water vapour to diffuse out and building components to dry.

MVHR or mechanical ventilation with heat recovery, to give it its full name, also known as heat recovery ventilation. This is a system that ventilates a building while also recovering heat from extracted air. It's typically installed as a centralised "whole building solution, but decentralised systems are emerging too, including single room ductless systems. MVHR systems typically extract warm, damp air from 'wet' rooms like kitchens and bathrooms and use it to heat cool, fresh incoming air, which is then usually piped to living spaces such as living rooms and bedrooms.

Performance gap The difference between how a building is designed to perform and how it subsequently does in reality once built. The term usually refers to energy consumption but can refer to other aspects of building performance too.

PHPP This is the Passive House Planning Package, the spreadsheet-based software that is used to design, verify and certify passive house and Enerphit projects.

Psi (ψ) values This is the 'linear thermal transmittance', the rate of heat flow per degree temperature difference per unit length of a thermal bridge. It is measured in W/mK, and is used to calculate the heat loss or gain through a thermal bridge. Under Irish and UK building regulations, the Psi-values for all non-repeating thermal bridges are multiplied by the measured length of each bridge before a Y-value for the building can be calculated, expressed in W/m^{2}K.

Relative humidity This is the amount of water vapour in the air relative to the amount the air can hold at the current temperature. Healthy relative humidity is generally regarded as being between 40% and 60%. High relative humidity can lead to condensation, dampness and mould.

Seasonal performance factor The ratio of useful heat energy output from a heat pump to the electrical energy input (including compressor, circulation pumps and electrical immersion, if present) averaged over an entire heating season.

Solar gain This refers to the heat energy that a building receives passively from the sun, normally through its glazing.

Space heating demand The amount of active heating input required to heat a building usually expressed in kWh/m^2/yr. It is often calculated using building energy software applications such as PHPP, Deap or Sap.

Strip foundation A strip of concrete running under all of a building's load bearing walls. This will normally include the external walls, and possibly some of the internal walls.

Surface to volume ratio This is the total external surface area of a building relative to its volume. A lower surface to volume ratio is generally more energy efficient, as it means there is less surface area from which heat can escape the building.

Thermal bridging, alternatively known as cold bridging, occurs when heat or cold transfers across an external surface of a building. This can cause heat to escape from the building or cold to enter. Thermal bridging occurs when a thermally conductive material (ie a material with low resistance to heat flow) penetrates or bypasses the insulation layer.

Thermostatic radiator valves are self-regulating valves, typically attached to radiators or other water heating systems, used to control the room temperature automatically based on what temperature the TRVs are set at.

U-value The U-value of a material is the rate of heat loss through that material. The lower the U-value of a material, the less heat can pass through it and the better it is at insulating. U-values are measured in watts per metre squared kelvin (W/m^{2}K).

Wall ties Material that bridges a wall cavity to join the inner and outer skins. They can be a point of thermal bridging but some modern wall ties are made from less thermally conductive materials.

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